

# **New Hampshire Statewide Forest Resources Assessment – 2010**

**Important Data and Information about New Hampshire's Forests**



**New Hampshire Department of Resources and Economic Development  
Division of Forests and Lands**

The *New Hampshire Statewide Forest Resources Assessment – 2010* is an update of:

New Hampshire Forest Resources Plan Revision Assessment Report  
2006  
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# **New Hampshire Statewide Forest Resources Assessment – 2010**

## **Introduction**

In 1996, New Hampshire's Forest Resources Plan was adopted after over a year of work by the Forest Resources Plan Steering Committee and the NH Division of Forests and Lands. By law, this Plan must be revised every ten years. This Assessment Report is essentially a background paper designed to provide the best information available about the status of New Hampshire's forests to facilitate a revision to the Plan with input from many stake holder groups. With assistance from the USDA Forest Service, the Division of Forests and Lands has decided to use the framework of the Montreal Process Criteria and Indicators as the basis for the Assessment report.

The Criteria and Indicators used for this assessment are a series of 7 Criteria and 18 Indicators and associated data sources that the USDA Forest Service, Northeastern Area (NA) and the 20 State forestry agencies in the Northeastern Area Association of State Foresters (NAASF) developed for use in ongoing monitoring efforts in this region. In this way, subsequent use of the framework will yield comparable results within districts (geographic areas like the State of New Hampshire) or among districts. The report is structured directly around these 7 Criterion and 18 Indicators.

Much has changed in the years since the 1996 Forest Resources Plan was adopted. This report is designed to focus on the major changes and trends affecting the forests of New Hampshire.

The completion of this Assessment has been guided by a data sub-group of the NH Forest Advisory Board with input from the full Forest Advisory Board, staff at the Division of Forests and Lands and many stakeholder groups.

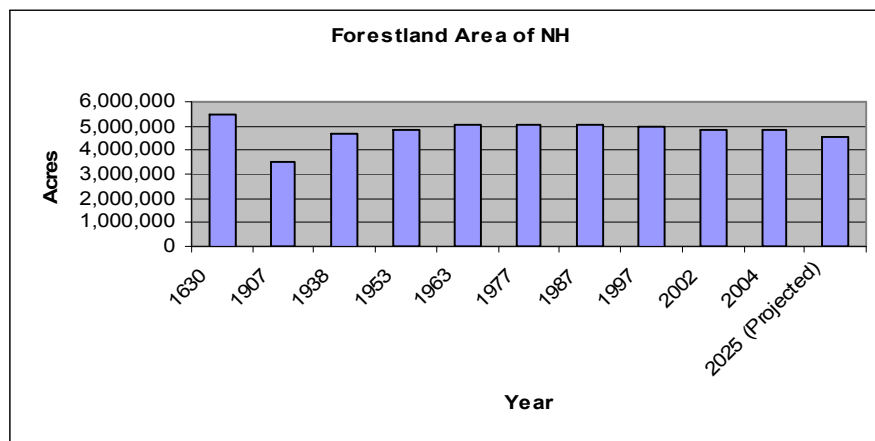
## **CRITERION 1:**

### ***Conservation of Biological Diversity***

#### ***1. Area of total land, forest land, and reserved forest land***

New Hampshire's forests are changing rapidly. Still considered the 2nd most forested state in the U.S. behind Maine at 84% forested, the Granite State continues to lose forestland each year to other land use—chiefly development. Of New Hampshire's 5,712,968 acres of land, since 1997 NH has lost 148,000 acres of forest to other land uses. We are projected to lose another 288,000 acres between now and 2025 — another 5% of our forests (USDA Forest Service, USDA NRCS and SPNHF). **Figure 1** shows the early decline of forested acreage in NH from settlement to the late 1800s followed by a steady increase until 1987 when loss to development began outpacing the reversion of farmland to forests.

**Figure 1**



*Source: USDA Forest Service, Forest Inventory and Analysis & SPNHF, NH's Changing Forest Landscape*

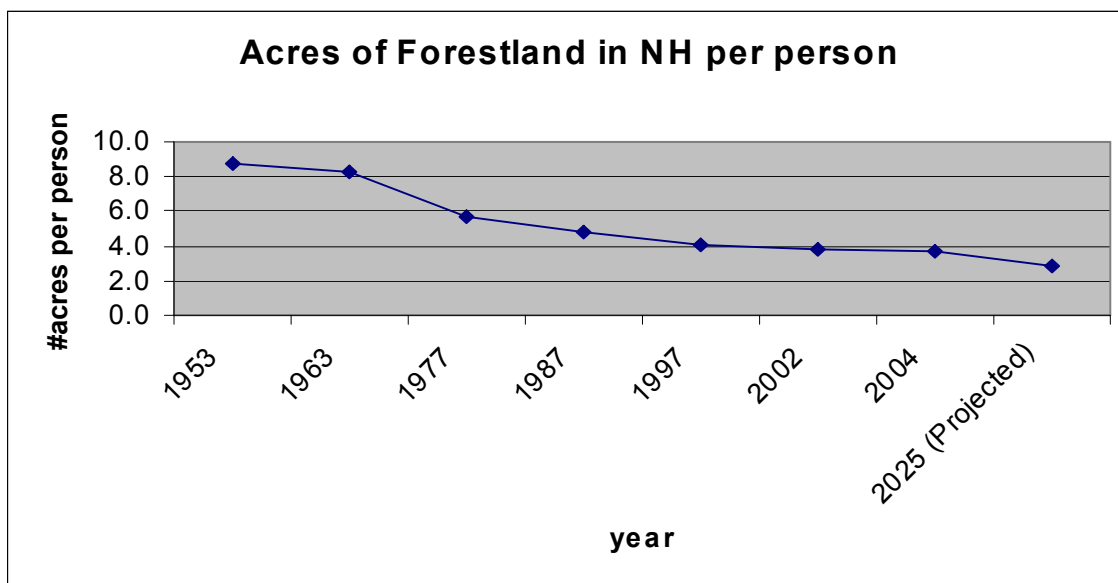
**Table 1** shows that the most significant projected loss of forestland will be in Hillsborough and Rockingham Counties.

Table 1—Projected Forest loss 2001-2025 (rounded to whole %)	
Belknap	3%
Carroll	2%
Cheshire	2%
Coos	0%
Grafton	1%
Hillsborough	4%
Merrimack	3%
Rockingham	4%
Strafford	3%
Sullivan	2%

*Source: SPNHF, NH's Changing Landscape and GRANIT*

New Hampshire's forests are most dense in Coos, Grafton and Carroll counties. As forest density statewide has declined statewide, population has increased. **Figure 2** shows that in 1953 NH had nearly 9 acres of forest for every person. Today that figure has dropped to under 4 acres of forest for every person.

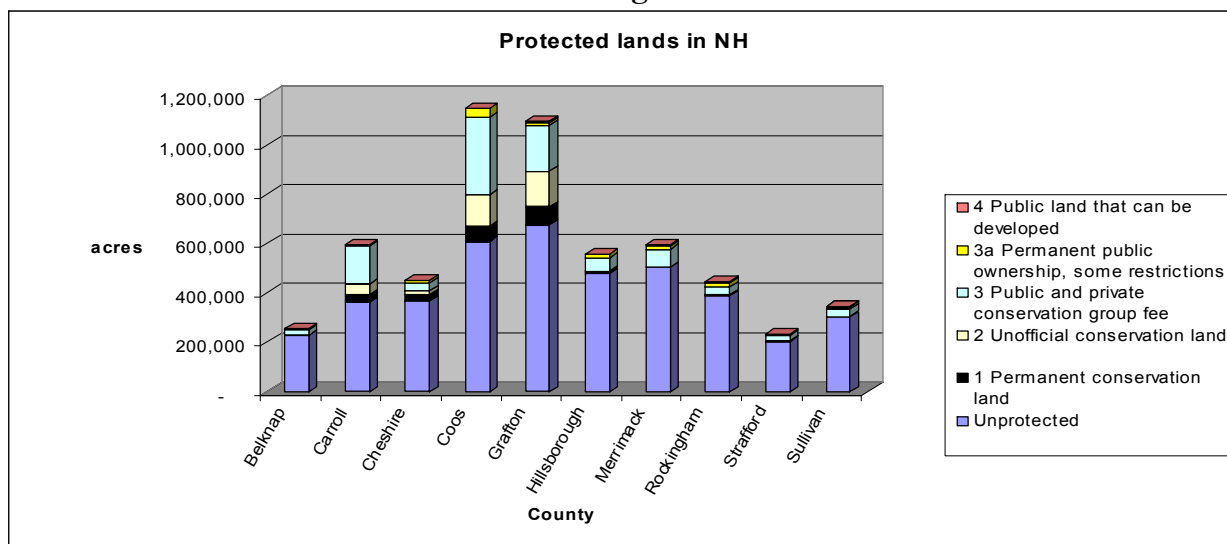
**Figure 2**



*Source: USDA Forest Service, Forest Inventory and Analysis, SPNHF, NH's Changing Landscape, US Census*

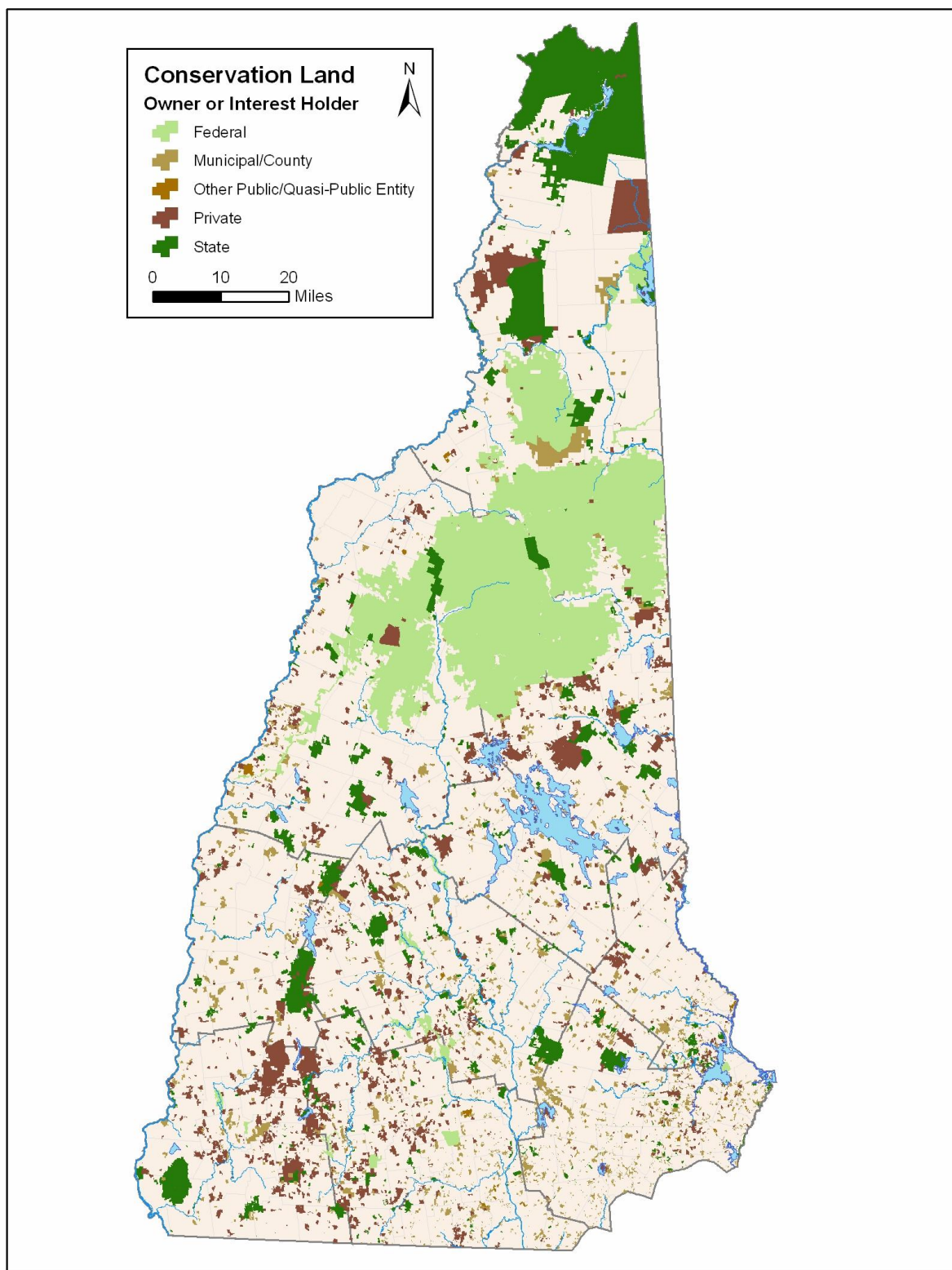
Permanently conserved land has increased from 1.2 million acres in 1998 to over 1.63 million acres in 2010 (GRANIT Consland Data Layer level 1). Included in that increase is the 171,000 acre Connecticut Lakes tract in northern NH, conserved in 2002. **Figure 3** shows conserved land in NH on a continuum based on protected status. This shows that most of the conserved land is still north of the lakes region (beginning with the White Mountain National Forests 760,000 acres). Most of the state's population is south of this.

**Figure 3**



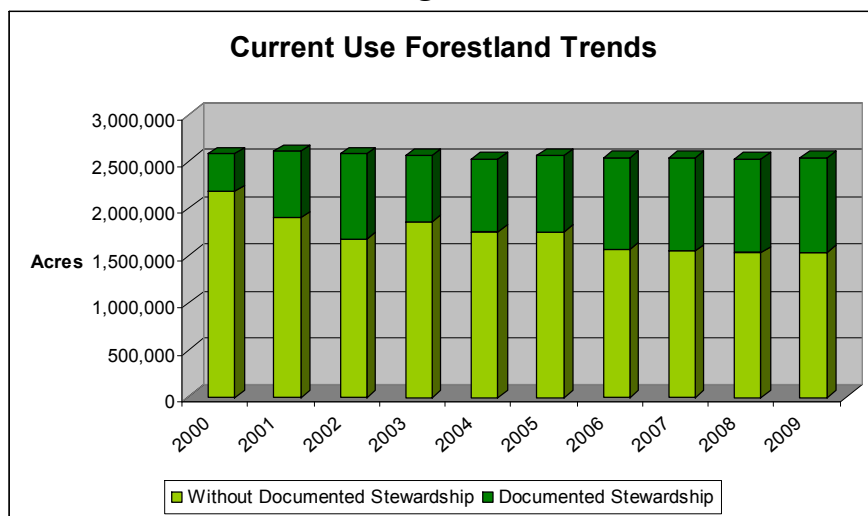
*Source: NH TNC and GRANIT*

**Figure 4** shows where conserved land is – providing more evidence that protected acres are not where NH’s population lives.



**Figure 5** shows current use lands in New Hampshire. Current use is a voluntary program that allows landowners who own 10 or more acres to be taxed at its “current use” as opposed to its highest and best use. While not permanently protected, this offers landowners a substantial tax savings in hopes of keeping the land open and undeveloped. This major public policy has been a significant deterrent to development, but it does not prevent development from occurring. Current use status does provide for more opportunities for permanent land conservation for state, federal and private land conservation interests. Enrollment in the Current use program has remained steady over the past decade, however enrollment in the “forestland with documented Stewardship” category has increased markedly. This category requires the landowner to have a management plan written by a licensed forester or to have the land in the Tree Farm program.

**Figure 5**



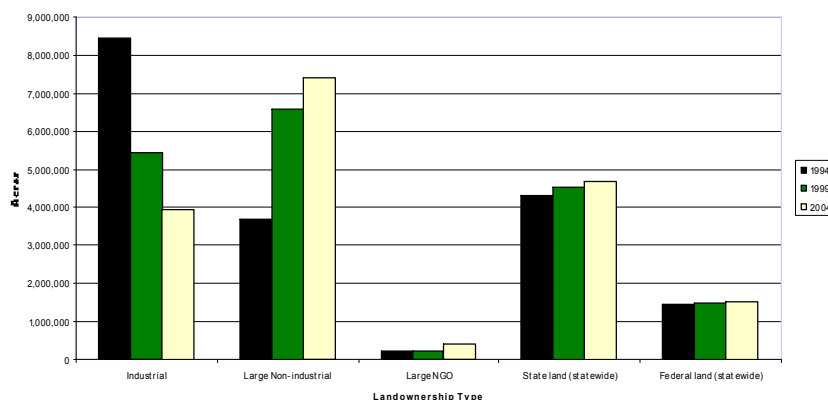
*Source: New Hampshire Department of Revenue Administration*

Forestland ownership is changing in New Hampshire, especially in the larger private ownership category. The Northern Forest Lands Council and the 10th Anniversary Forum that revisited this work in 2005 concluded that significant forestland ownership changes have occurred in the large private ownerships of the four-state northern forest region stretching from Maine to New York.

**Figure 6** paints the clearest picture possible explaining the changes in large forest ownerships in the region. From 1994-2004, almost 5 million acres of forestland, largely in the northern portions of Maine, New

**Figure 6**

#### Northern Forest Landownership - ME NH, VT & NY



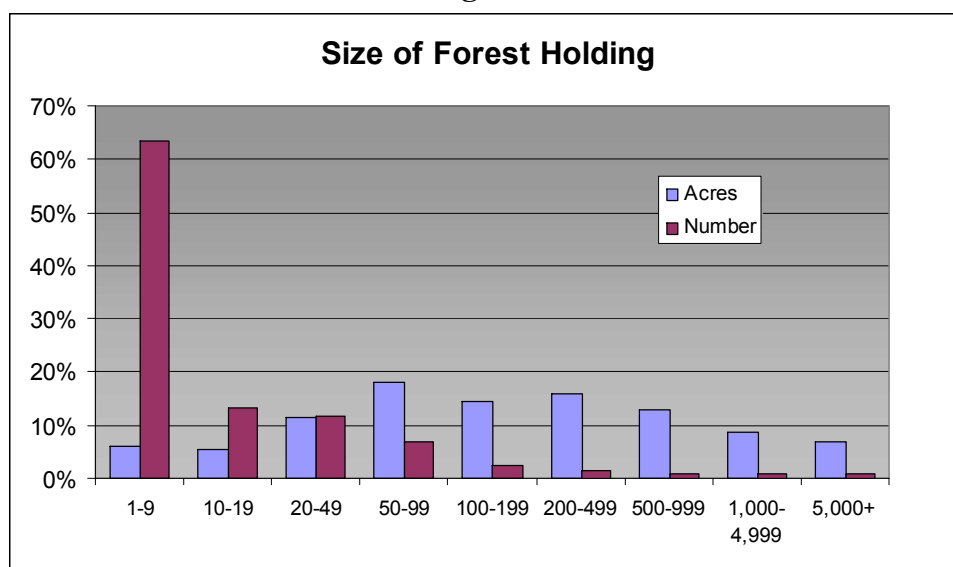
*Source: North East State Foresters Association (NEFA)*

Hampshire, Vermont and New York, went from industrial forest ownerships— i.e. those ownerships connected to forest products manufacturing – to Timberland Investment Management Organizations (TIMO). TIMOs use investor funds to purchase these forestland assets and manage the lands for a period of time, typically 7-10 years, before re-selling the lands. The return on the investment is chiefly made through appreciated land values, timber management, selling of high value development parcels and sometimes conservation-related transactions (such as sale of a conservation easement).

New Hampshire's portion of the TIMO trend is significant. No large industrial timberland remains in the state. The largest remaining industrial ownerships — the Connecticut Lakes 170,000 ownership formerly owned by International Paper and Champion International previously in the Pittsburg area and the over 120,000 Mead Westvaco ownership in the Androscoggin River valley — both went to TIMOs in the early 2000's. Some fragmentation and change in ownership to public land resulted from many of the industrial to TIMO changeovers.

**Figure 6** also suggests very minor additions to federal and state ownerships in the 10-year period ending in 2004.

**Figure 7**



*Source: National Woodland Owners Survey, USDA Forest Service*

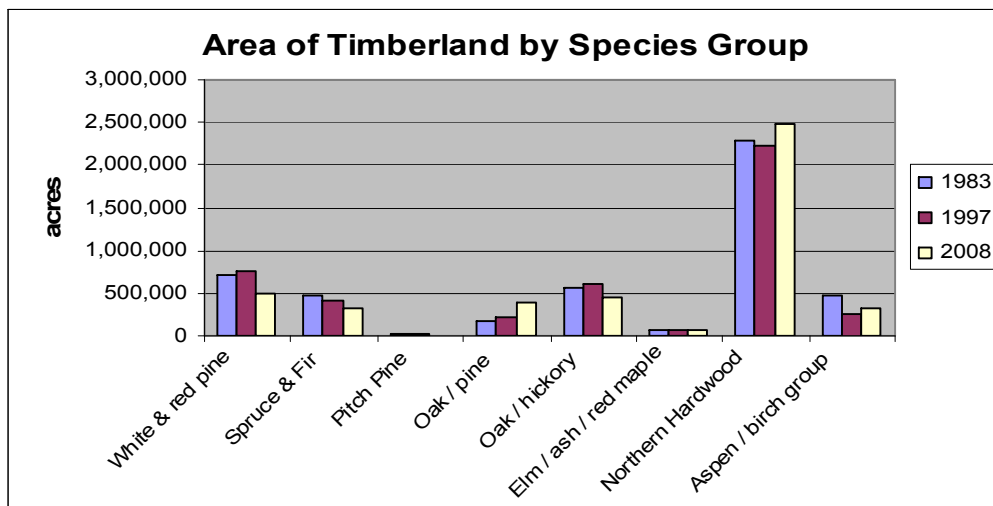
While the large private ownerships changed type, smaller ownerships, especially south of the lakes region, got even smaller. From 1993 and 2003, parcel size in New Hampshire has been reduced. In the 500-999 acre size-class, the data suggests a 50% drop in acreage. In the 1-9 acre category, a 7% increase was seen. **Figure 7** shows the current number and acreage of private land holdings. These kinds of changes in the smaller size classes are not readily visible but the “nibbling” effect of size-class changes in the smaller landownership classes can be quite serious — especially in the loss of the 500 acre+ size classes since they provide for such a wide-range of public and private benefits.

Approximately 49%, or 2.36 million acres, of forestland are owned by 124,000 family forest owners in New Hampshire. Most interestingly, only 4% of family forestland owners are under 45 years of age, 45% are between 45 and 64 and, 51% of owners are 65 or older. This demographic data implies a large percentage of forest land may be sold or past down to heirs in the near future, increasing the chances of parcelization.

## Forest type and size class

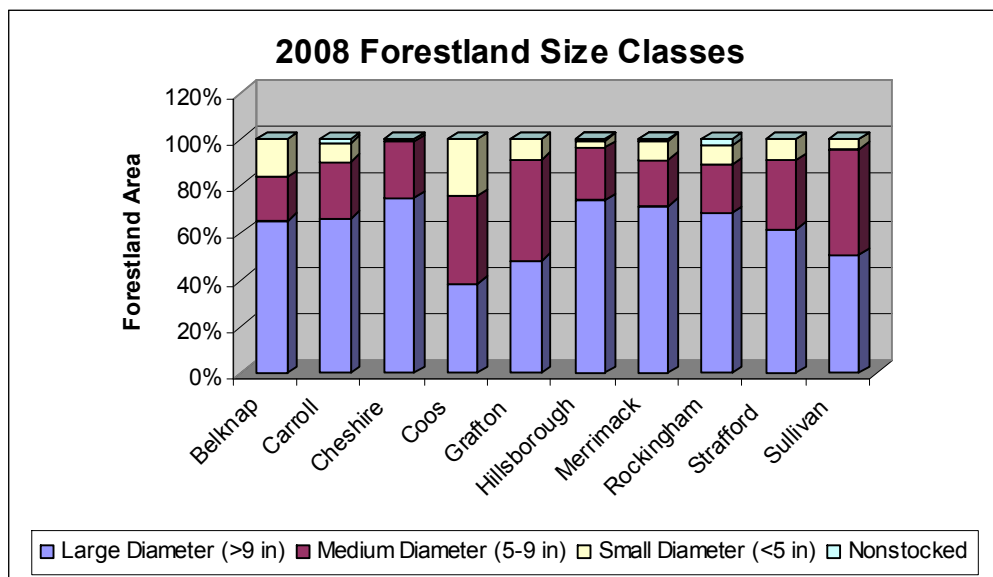
In acreage terms, New Hampshire's forests are dominated by northern hardwood. **Figure 8** shows that approximately 2,500,000 acres are found in this category. The next largest forest type category is white pine, followed by oak/hickory and spruce fir. Many of the changes in forest acreage from 1983 to 2008 have been minor however, Spruce and fir forests are on the decline. The aspen/birch type lost of about 50% during the period between 1983 and 1997 but rebounded slightly by 2008, as did northern hardwoods.

**Figure 8**



Source: USDA Forest Service, Forest Inventory & Analysis

**Figure 9**



Source: USDA Forest Service, Forest Inventory & Analysis

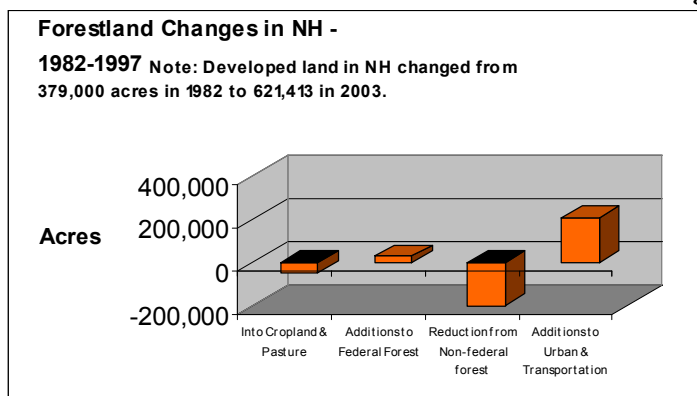
Size and age classes of most of New Hampshire's forest are increasing. **Figure 8**, however, shows that Coos and Grafton Counties both have less than 40% of their forest cover in larger diameter forest

stands (larger than 9 inches in diameter). **Figure 9** shows that statewide, New Hampshire's forests are getting older and larger.

## 2. *Extent of forest land conversion, fragmentation, and parcelization*

Understanding specifically the historical changes in land use should be helpful in deciding priorities for the future. **Figure 10** shows that most of the reduction in forestland acreage from 1983-1997 resulted from urbanization or development of forest with structures and pavement.

**Figure 10**

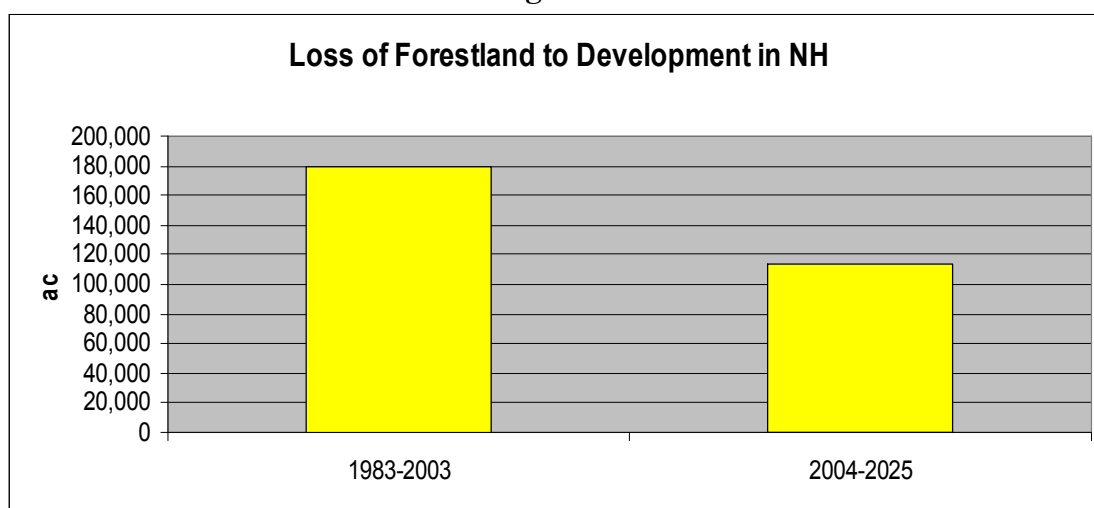


Source: Natural Resource Conservation Service and SPNHF

One can expect similar changes to the present and into the future with 4% losses in forestland projected from the present until 2025 in Rockingham and Hillsborough counties. Interestingly, some land is still reverting from forest to farm pasture and cropland — though only a small amount.

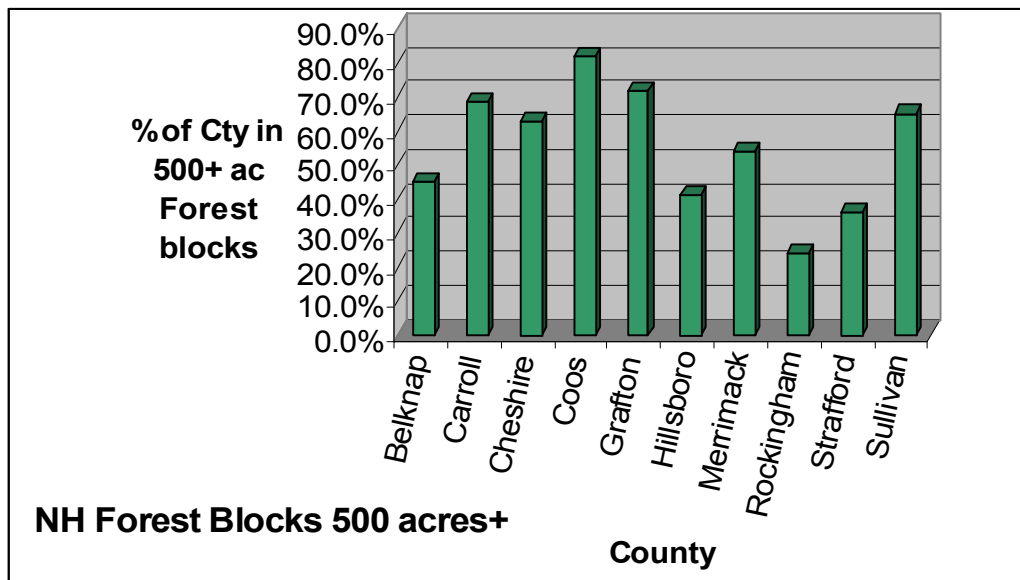
Statewide, it is expected that over 115,000 additional acres of forestland will be lost to development by 2025 (**Figure 11**). **Figure 12** shows a key wildlife habitat result of this fragmentation – the most populous and developed counties (Hillsboro, Rockingham and Strafford) have the fewest 500+ acre blocks of forestland, a key attribute for wide-ranging wildlife species such as moose and bear.

**Figure 11**



Source: USDA Forest Service FLA & SPNHF, NH's *Changing Landscape* for the projection

**Figure 12**



Source: SPNHF, NH's Changing Landscape

### 3. Status of forest/woodland communities and associated species of concern

Given the amount of development and fragmentation occurring across New Hampshire's forested landscape, wildlife and plant species are at risk of population reduction or even extirpation in some cases. New Hampshire's Wildlife Action Plan (WAP) is the definitive source to review for possible effects on the state's wildlife communities. According to the WAP, fully twenty-six habitat types in New Hampshire are at risk and are in need of permanent conservation (habitats of conservation concern). **Table 2** shows the list – which covers most of the state's habitat types. This further reinforces what we know about the development paradigm we are experiencing: it is affecting all the land types in NH.

**Table 2**

#### **New Hampshire's habitats of greatest conservation need based on wildlife species.**

##### **Watershed Groupings**

Connecticut River Mainstem Watershed  
 Southern Upland Watersheds  
 Northern Upland Watersheds  
 Montane Watersheds  
 Coastal Transitional Watersheds  
 Non-Tidal Coastal Watersheds  
 Tidal Coastal Watersheds

##### **Matrix Forest Types**

Appalachian Oak-Pine Forests  
 High-Elevation Spruce-Fir Forest  
 Lowland Spruce-Fir Forest  
 Northern Hardwood-Conifer Forest  
 Hemlock-Hardwood Pine Forest

##### **Medium and Small Scale Habitats**

Alpine  
 Grassland  
 Shrublands  
 Caves and Mines  
 Cliffs  
 Coastal Islands  
 Dunes  
 Floodplain Forests  
 Marsh and Wet Meadows  
 Shrub Wetlands  
 Peatlands  
 Pine Barrens  
 Rocky Ridges and Talus Slopes

Source: NH Wildlife Action Plan

The 26 habitats of conservation concern include five large-scale matrix forest types: Appalachian oak-pine, hemlock-hardwood-pine, northern hardwood-conifer, lowland spruce-fir, and high-elevation spruce-fir. Two small-scale forest types are also included: pitch pine and floodplain forest.

The WAP also identifies 124 wildlife species of conservation concern in New Hampshire. Of these, 47 species (38%) are associated with matrix forests (**Table 3**). One species is federally endangered, one is federally threatened, seven are state endangered, and 10 are state threatened. Canada lynx bridges two of these categories and is classified as federally threatened and state endangered. By taxa, forest related species of conservation concern include five amphibians, eight reptiles, 23 birds, and 11 mammals. A more comprehensive list of wildlife of concern (includes all endangered and threatened and other species of concern) can be found in the Appendix.

If species associated with pitch pine and floodplain forest were included, the list of species would increase by twelve for a total of 60 species (48%) associated with forests. Eleven of the twelve additional species are rare insects associated only with pitch pine forests in New Hampshire.

Three matrix forest types (Appalachian oak-pine, hemlock-hardwood-pine, and lowland spruce-fir) along with pitch pine forest are among the most at-risk habitats in the state. The three matrix forest types together comprise 72% of New Hampshire's land area. As can be expected, risk intensity varies considerably within this extensive area.

Risk to Appalachian oak-pine and hemlock-hardwood-pine forest is highest in the southern part of the state where development pressures are the highest. Lowland spruce-fir occurs primarily in the northern part of the state. Historical harvesting practices in some areas of northern New Hampshire have resulted in conversion of former spruce-fir sites to northern hardwood-conifer forest. A comparison of lowland spruce-fir data developed for the WAP and current spruce-fir cover as depicted by the 2001 New Hampshire Landcover Assessment from the GRANIT Geographic Information System source indicates that there is 45% less spruce-fir forest than what could occur naturally.

**Table 3**

Wildlife species of conservation concern associated with matrix forest types in New Hampshire.

E = NH endangered (List revised 2008), T = NH Threatened (List revised 2008), SC = NH special concern (List revised 2009).

RC = Regional Conservation Concern (2009), FE = Federally endangered (2008), FT = Federally threatened (2008)

#### **Amphibians**

Jefferson salamander <sup>SC, RC</sup>

Blue-spotted salamander <sup>SC, RC</sup>

Fowler's toad <sup>SC</sup>

Northern Leopard frog <sup>SC, RC</sup>

Marbled salamander <sup>E</sup>

#### **Reptiles**

Timber rattlesnake <sup>E</sup>

Blandings turtle <sup>E</sup>

Eastern hognose snake <sup>E</sup>

Spotted turtle <sup>T</sup>

Black Racer <sup>T</sup>

Wood Turtle <sup>SC, RC</sup>

Eastern box turtle <sup>SC, RC</sup>

Smooth green snake <sup>SC</sup>

#### **Birds**

Common nighthawk <sup>E</sup>

Bald Eagle <sup>T</sup>

Sedge wren <sup>E</sup>

Common loon <sup>T</sup>

American three-toed

Woodpecker <sup>T</sup>

Grasshopper sparrow <sup>T</sup>

Pied-billed grebe <sup>T</sup>

Bald eagle <sup>T</sup>

Peregrine falcon <sup>T</sup>

Rusty blackbird <sup>SC</sup>

#### **Birds (cont'd)**

Spruce grouse <sup>SC</sup>

Osprey <sup>SC</sup>

American kestrel <sup>SC</sup>

Sora <sup>SC</sup>

Common moorhen <sup>SC</sup>

Whip-poor-will <sup>SC, RC</sup>

Olive-sided flycatcher <sup>SC</sup>

Horned lark <sup>SC</sup>

Purple martin <sup>SC</sup>

Bicknell's thrush <sup>SC, RC</sup>

American pipit <sup>SC</sup>

Golden-winged warbler <sup>SC, RC</sup>

Cerulean warbler <sup>SC, RC</sup>

#### **Mammals**

Canada lynx <sup>E, FT</sup>

Small-footed bat <sup>E</sup>

Gray wolf <sup>FE</sup>

New England cottontail <sup>E</sup>

American marten <sup>T</sup>

Eastern red bat <sup>SC, RC</sup>

Hoary bat <sup>SC, RC</sup>

Silver-haired bat <sup>SC, RC</sup>

Northern long-ear bat <sup>SC</sup>

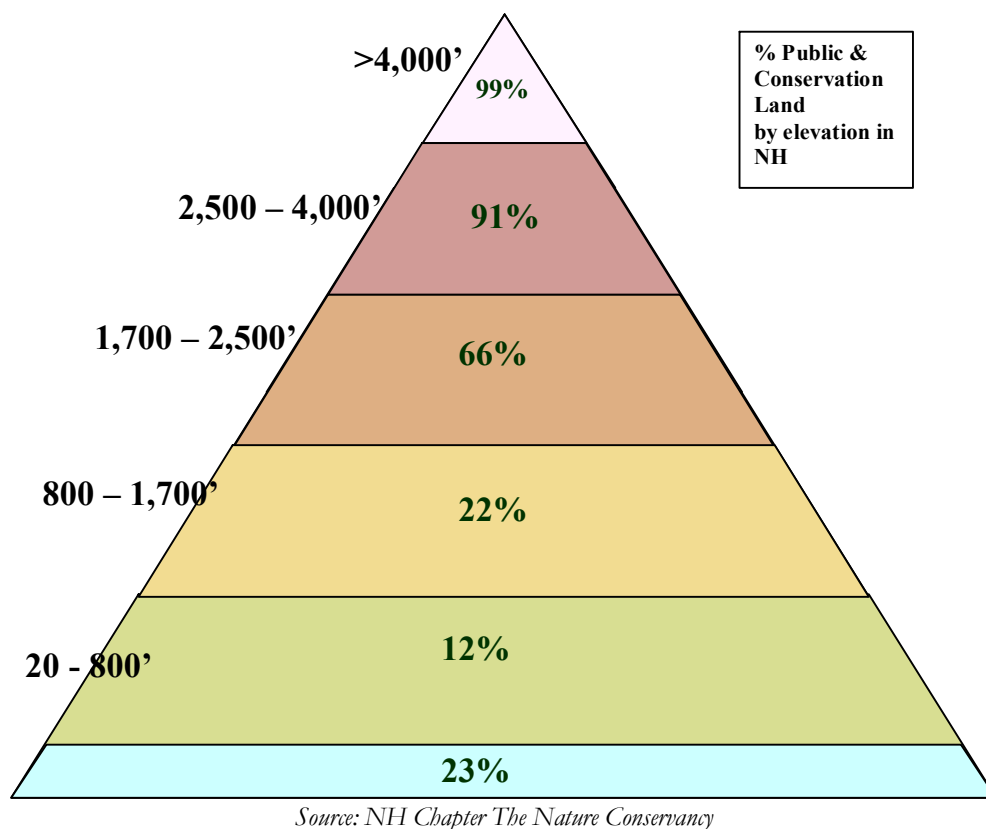
Tricolored bat <sup>SC</sup>

Northern bog lemming <sup>SC, RC</sup>

Development and fire suppression are considered the biggest risks to pitch pine habitats. New Hampshire had at one time supported intact pitch pine barrens, along the Merrimack River from Concord to Nashua and in the towns of Ossipee, Freedom, Tamworth, Madison, and Effingham. Increased development and urban sprawl throughout the state drastically reduced the extent of these communities. Both the Nashua and Manchester pine barrens have been entirely altered, while about 560 acres of the historic Concord Pine Barrens and 43% of the Ossipee pine barrens remain today.

An interesting breakdown of permanently protected acreage by elevation developed by the NH Chapter of The Nature Conservancy shows that most of the protected acreage in the state is at higher elevations (**Figure 13**) while, over 70% of the protected acreage is north of the lakes region. This shows that the current permanently conserved acreage in New Hampshire is uneven at best.

Figure 13



New Hampshire is a diverse environment with a multitude of plant and animal species. To this end the Natural Heritage Bureau has developed a scientific approach to classifying these recurring assemblages of plants and animals. The bureau has described 193 natural communities; which are based on plant species composition, physical structure (like a forest or grassland) and a set of physical conditions (like local climate or water availability). The Bureau's primary mission is to collect and analyze data on the status, location, and distribution of rare or declining plant species and exemplary natural communities. Additionally, they develop and implement measures for the management of native plants.

Currently, New Hampshire has 397 taxa listed as endangered and threatened under the Native Plant Protection Act<sup>1</sup>.

<sup>1</sup> The Native Plant Protection Act ([RSA 217-A](#)) purpose recognizes that "for human needs and enjoyment, the interests of science, and the economy of the state, native plants throughout this state should be protected and conserved; and . . . their numbers should

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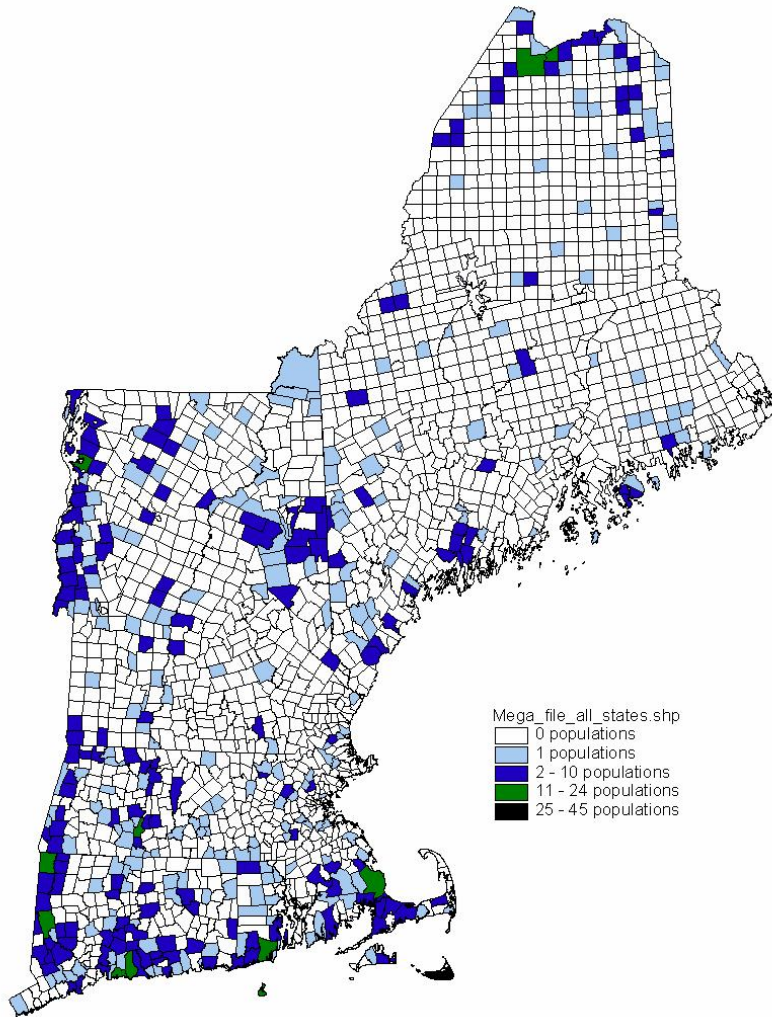
Many federal, state, and local agencies that issue permits or provide grants require that applicants contact the NH Natural Heritage Bureau to check for potential impacts to known occurrences of rare species or exemplary natural communities. To facilitate the process of requesting a review, an online "DataCheck Tool" was developed in 2007. The first year the tool was available more than 1,400 reviews were generated, 2,661 were completed in 2009.

The regional study, *Patterns in Biogeographic Dynamics and Decline of 71 Rare Plant Species in New England: Evidence from Historical Collections and Contemporary Monitoring*, discusses the importance and complexity of analyzing species occurrence data. An excerpt from the abstract of this research paper best describes the information:

"Detecting range shifts and contractions is critical for determining the conservation priority of rare and declining taxa. However, data on rare species occurrences frequently lack precise information on locations and habitats, and may present a biased picture of biogeographic distributions and presumed habitat preferences..." "Using data from herbaria and Natural Heritage Programs on numbers of occurrences within individual municipalities (towns, cities, or townships), we quantified temporal changes in the estimated distributions of 110 rare plant species in the six New England states..." "we eliminated taxa with high probabilities of pseudo-absence (that would yield an inaccurate profile of species distributions), narrowing the set for final analysis to 71 taxa. We then expressed occurrences as centroids of town polygons and estimated current and historical range areas (extents of occurrence as defined by  $\alpha$ -hulls inscribing occurrences), mean distances between occurrences and latitudinal and longitudinal range boundaries. Using a geographic information system, we modeled first, second, and third circular standard deviational polygons around the mean center of the historical range. Examining the distribution of current occurrences within each standard deviational polygon, we asked whether ranges were collapsing to a center, expanding, fragmenting, or contracting to a margin of the former range. Extant ranges of the species were on average almost 67% smaller than their historical ranges and distances among occurrences decreased. Five New England hotspots were observed to contain over 35% of rare plant populations. Extant occurrences were more frequently marginalized at the periphery of the historical range than would be expected by chance. Coarse-grained data on current and historical occurrences can be used to examine large suites of species to prioritize taxa and sites for conservation."

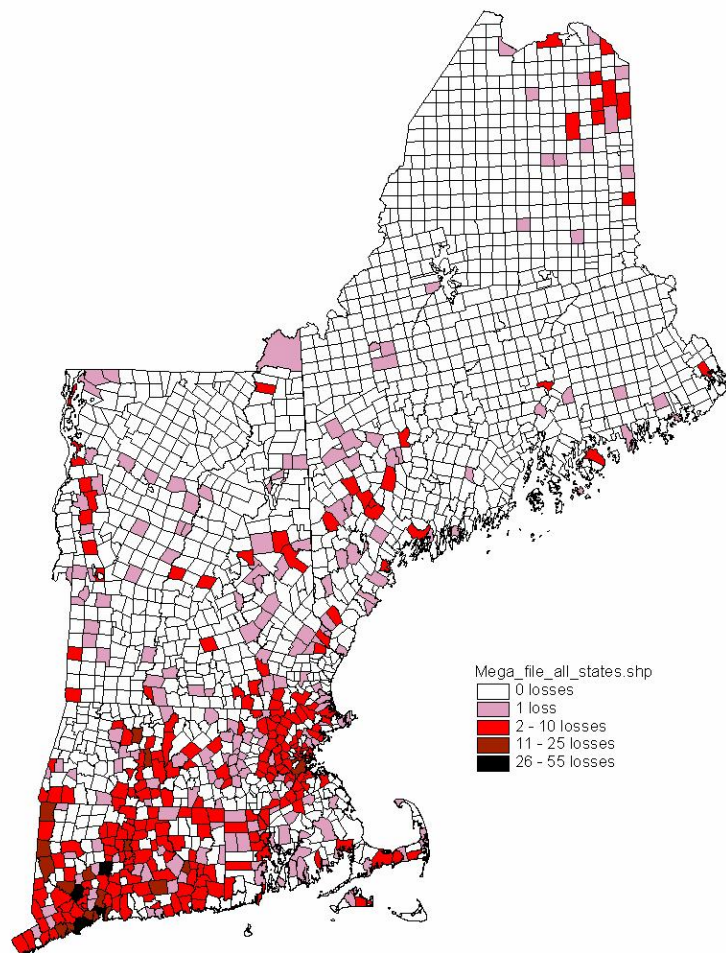
Resulting maps from this project are very instructive. **Figures 14 and 15** show distribution of 71 rare plant species in New Hampshire and surrounding New England states with the extent of the loss in the latter coming from comparisons of historic distribution records with current records.

**Figure 14**  
**Distribution of 71 species of existing rare plants in New England**



*Source: PATTERNS IN  
 BIOGEOGRAPHIC DYNAMICS AND  
 DECLINE OF 71 RARE PLANT  
 SPECIES IN NEW ENGLAND:  
 EVIDENCE FROM HISTORICAL  
 COLLECTIONS  
 AND CONTEMPORARY  
 MONITORING. Hamm and Everett*

**Figure 15**  
**Comparing historic and current distributions in New England (same 71 species)**  
**Darker areas indicate areas with high populations losses**

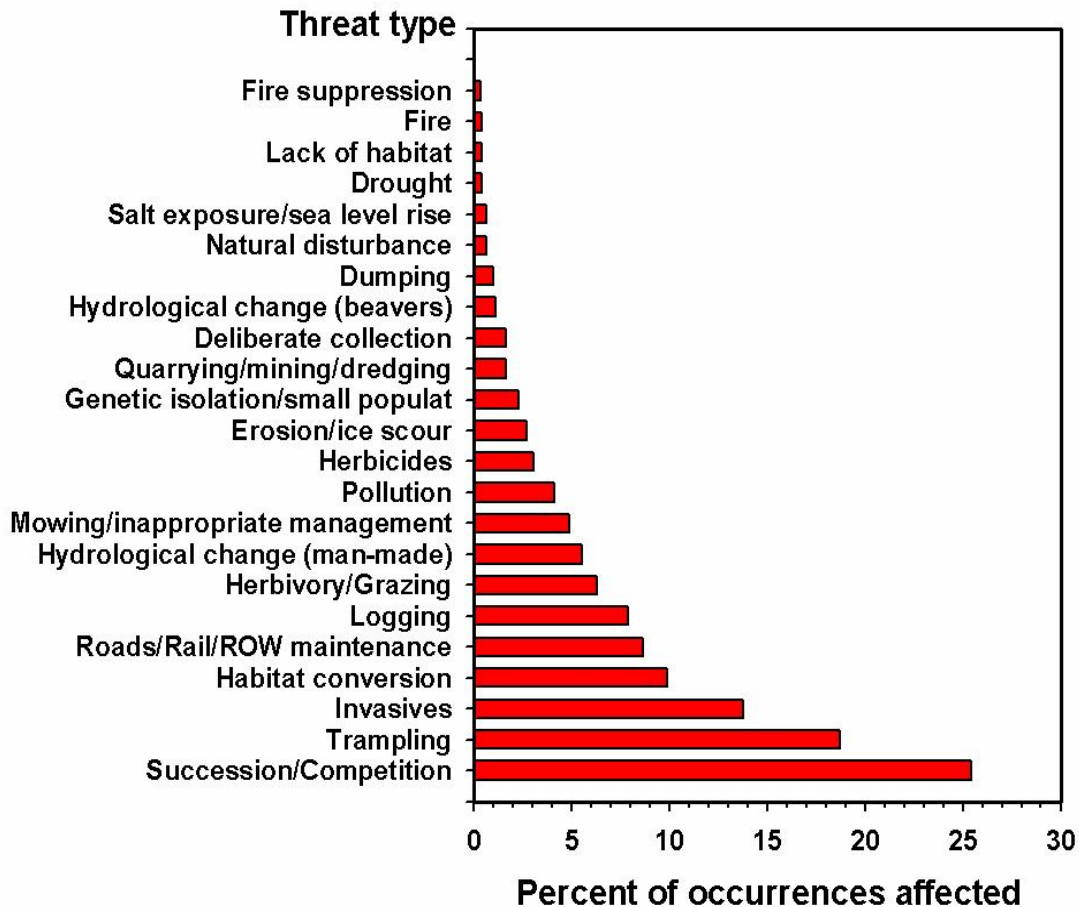


*Source: PATTERNS IN BIOGEOGRAPHIC DYNAMICS AND DECLINE OF 71 RARE PLANT SPECIES IN NEW ENGLAND: EVIDENCE FROM HISTORICAL COLLECTIONS AND CONTEMPORARY MONITORING, Harvard Forest*

As expected, more loss of rare plant species distribution is found in southern NH south of the White Mountain National Forest. Perhaps a more important body of data is found in **Figure 15** but in Connecticut, Rhode Island and Massachusetts where much more significant loss of species distribution was found. This may be a premonition for the future in New Hampshire if habitat is not conserved.

**Figure 16** shows the threat level to these same species from various anthropomorphic and natural factors. Invasives and succession of plant species ranks high on the list but so do human caused trampling and habitat loss.

**Figure 16**  
**Major Threats to Rare Plant Species in New England**



*Source: PATTERNS IN BIOGEOGRAPHIC DYNAMICS AND DECLINE OF 71 RARE PLANT SPECIES IN NEW ENGLAND: EVIDENCE FROM HISTORICAL COLLECTIONS AND CONTEMPORARY MONITORING, Harvard Forest*

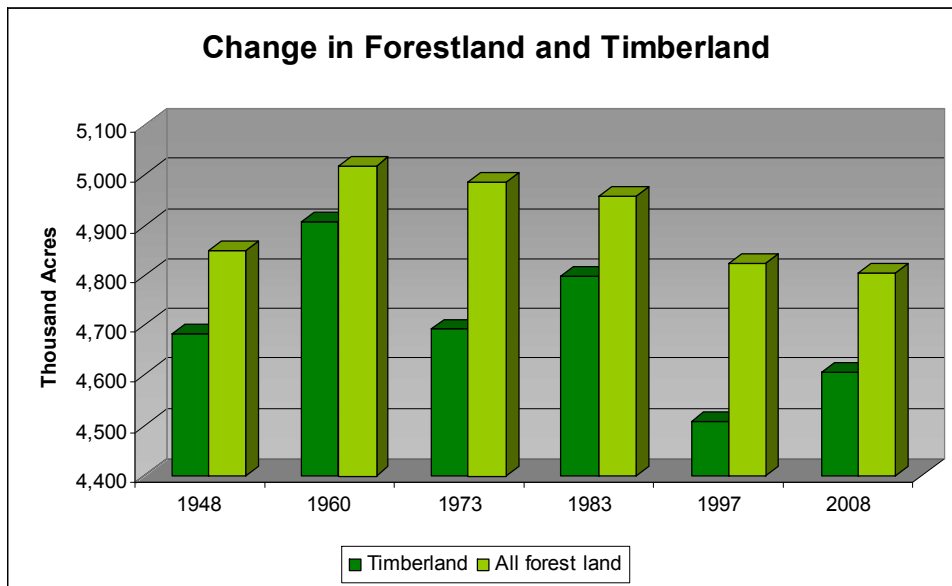
## **CRITERION 2:**

### **Maintenance of Productive Capacity of Forest Ecosystems**

#### ***4. Area of timberland***

As with all forestland, timberland acreage has declined in the last 50 years in New Hampshire. Timberland is forestland capable of producing 20 cubic feet of wood/acre/year<sup>2</sup>. **Figure 17** shows that we have lost over 300,000 acres to non-timberland uses since 1953 – from 4,875,000 acres statewide to 4,575,000 acres. Some of the oscillation in the timberland numbers are due to sampling techniques and the fact that the definition of timberland has changed since the earlier inventories.

**Figure 17**  
**NH Timberland Acreage**

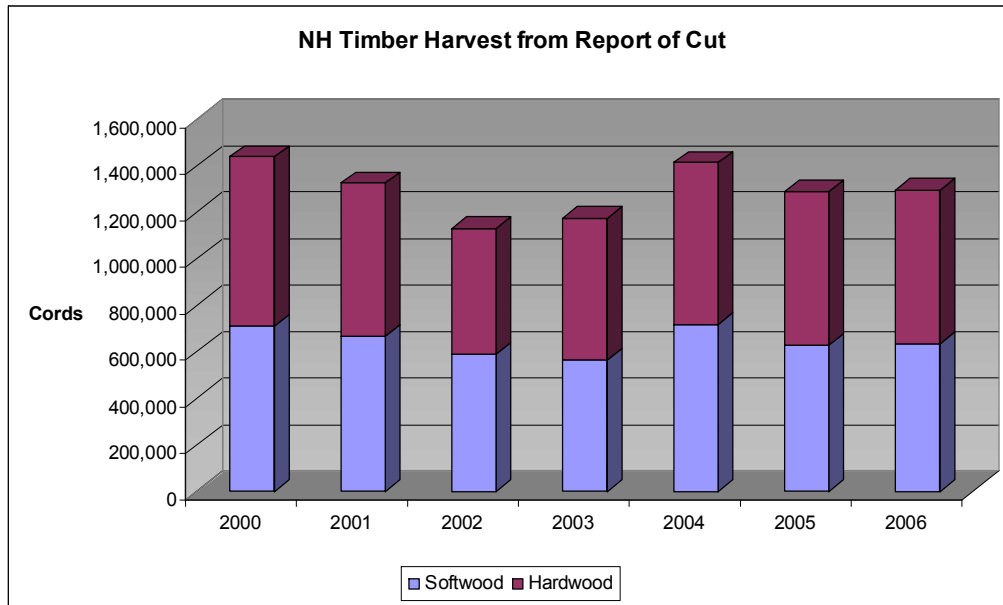


Source: FIA Timberland = forest capable of producing 20 cubic feet of wood/acre/year

#### ***5. Annual removal of merchantable wood volume compared to net growth***

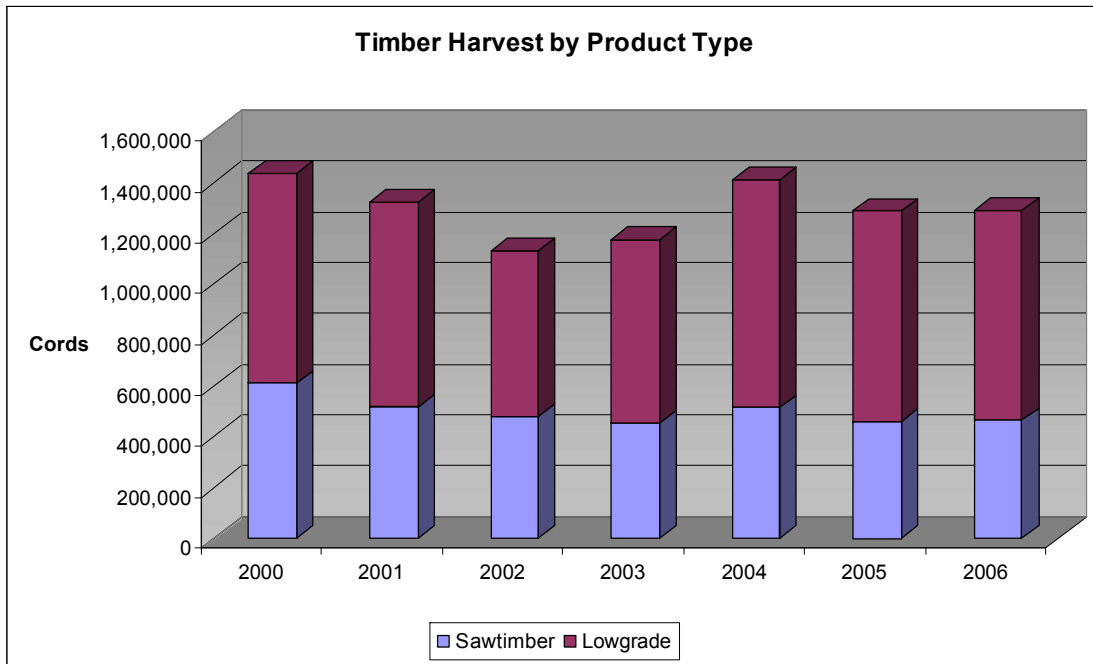
While timber is only one area of economic output associated with forests in New Hampshire, it is the most significant. Details of the economic value of the forest-related industries can be found later in this report. Given this, understanding the state of timber volumes and growth and harvest levels is critical to understanding the current state of New Hampshire's forests. **Figure 18** shows annual harvest levels by softwood and hardwood and then by product class in **Figure 19**. Softwood and hardwood harvests are roughly equal but lower quality wood is the majority of the timber harvested.

**Figure 18**



*Source: NH Division of Forests & Lands*

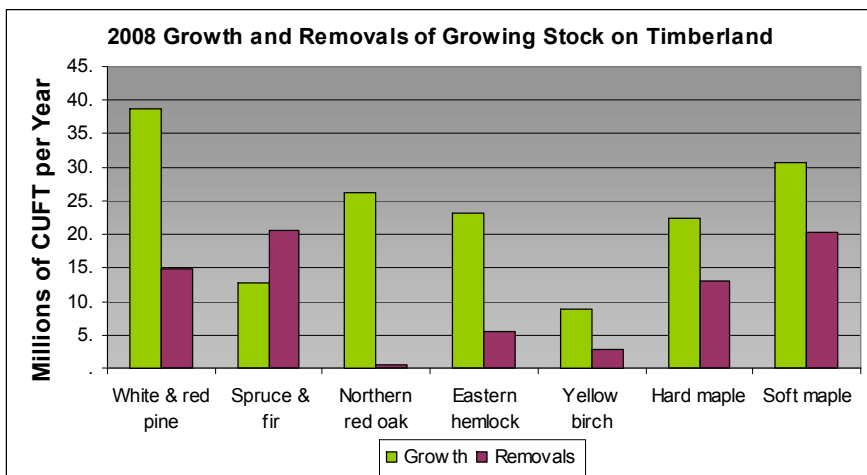
**Figure 19**



*Source: NH Division of Forests & Lands*

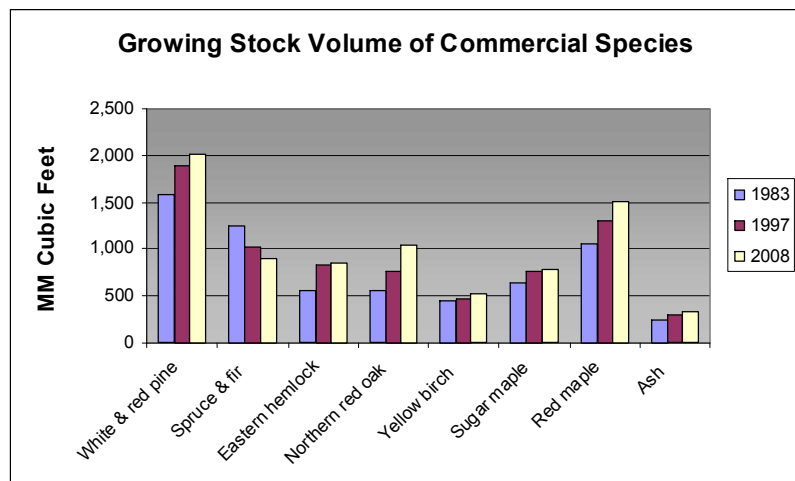
**Figure 20** shows in gross that, harvest levels are less than net growth. This suggests that overall timber volumes are increasing though the loss of forestland to development more than likely negates this increase in terms of availability. More revealing, however, is a closer look at growth and removals at the sub-state level. **Figure 21** looks at the growth to removal ratios for selected species. This figure suggests that removals of balsam fir and spruce may be in excess of growth. Continued harvesting at levels over net growth will result in a reduction in the timber inventory for these species. More analysis at sub-state levels might reveal more useful information.

**Figure 21** (Source FIA)

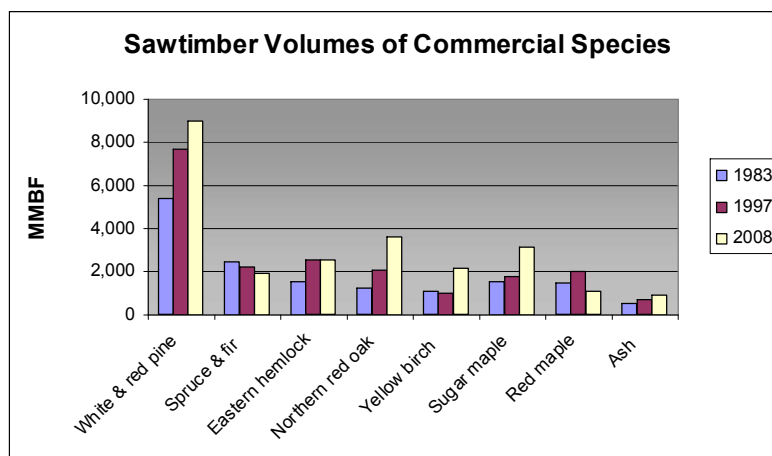


both hardwood and softwood from 1983 to 2008.

**Figure 22** (Source FIA)



**Figure 20** (Source FIA)



Growth of timber volumes can be better viewed in standing volume data. **Figure 22** shows standing timber volume data for the years 1983, 1997 & 2008. The trends suggest that increased volumes in hardwood and most softwood species for the period. This further confirms that, in gross, NH timber harvesters are cutting less than growth in both softwood and hardwood as we have generally increasing inventories of timber over this 20 year time period. Additionally, sawtimber size class is increasing in

Taken together, these data show clearly that we have increasing inventories of standing timber in New Hampshire and that, statewide, we are harvesting less each year than the growth from our forest. This is not to say that imbalances in growth to harvest levels do not exist in smaller geographic regions or in species, because the data suggests they may.

Further, these data do not confirm availability of standing timber for harvest, another topic entirely and for which no reliable new data exists. Some availability work was done for New Hampshire in 1995 as part of an update to the FIA data called

the New Hampshire Forest Inventory Project (NHFIP). This study sought to understand how much land is unavailable for timber harvesting at any given moment in time due to the myriad of regulatory and landowner attitude constraints. An excerpt from the executive summary of the project states:

- “701,000 acres of forest land in the North Unit [Coos, Grafton & Carroll Counties] and 227,028 acres of forest land in the South Unit [southern 7 counties] are not available for timber harvest due to non-landowner attitudinal harvest constraints<sup>3</sup>. Landowner attitudinal harvest constraints represent 2,529,844 acres statewide. Total acres not available statewide then are 3,457,872 acres of forest land. This is 75% of the forest land in New Hampshire. This leaves 1,147,891 acres available for harvesting.
- The acres not available for harvest represent 5.701 billion cubic feet or 10.896 billion board feet of standing timber volume statewide. The non-landowner attitudinal acres represent 1.200 billion cubic feet or 2.670 billion board feet of timber in the North Unit and 243.288 million cubic feet or 717.104 million board feet of timber in the South Unit.
- The non-landowner attitude constraints represent 29 % of the forest land in the North Unit and 11 % of the forest land in the South Unit. The landowner attitudinal constraints alone represent 55% of New Hampshire’s forest land (not available for harvest).
- The volume figures above represent all of the merchantable timber on the constrained acres -- using a figure of approximately 10 cords per acre (an average harvest volume) -- the volume of harvestable timber affected is 35.08 million cords.”<sup>4</sup>

While produced in 1995 with the expressed disclaimer that this data was a snapshot in time not intended for use in other timeframes, this analysis, nevertheless, gives an idea that the timber availability issue is of a sufficient magnitude to warrant extreme caution in reviewing timber volumes for New Hampshire.

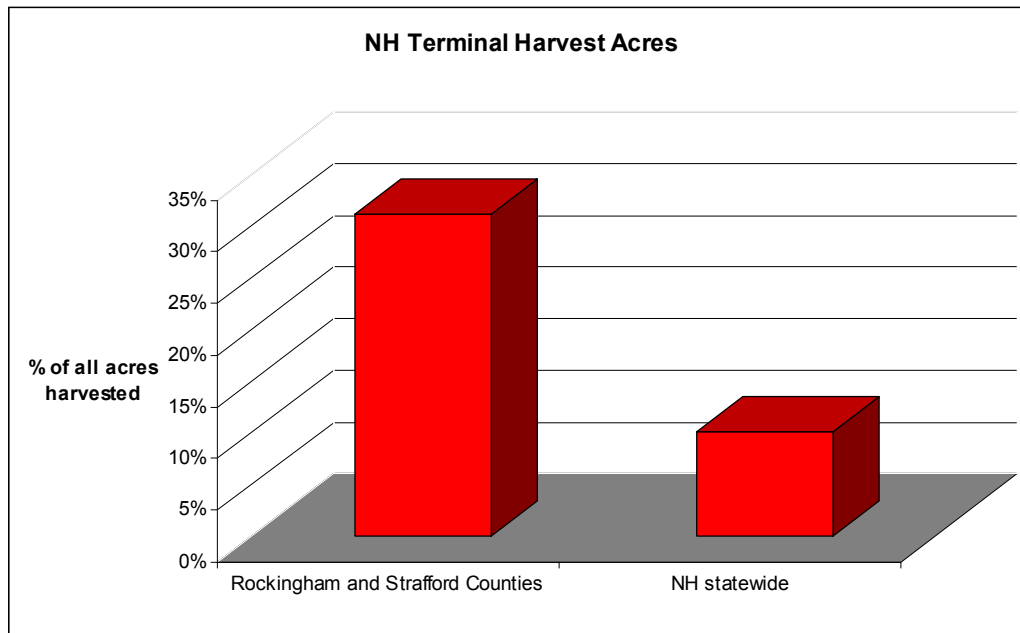
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<sup>3</sup> these are regulation and physical constraints

<sup>4</sup> N.H. Forest Inventory Project - *Timber Availability Analysis* 1995

One final note of importance regarding timber availability is the issue of *terminal harvests* – those timber harvests that occur prior to conversion of land to a developed use. A 2001 study from the Society for the Protection of NH Forests entitled *NH's Vanishing Forests*, looked at, among other issues related to the title, terminal harvests. **Figure 23** from that report shows that nearly 30% of timber harvest acres in Rockingham and Strafford Counties were terminal harvests while the state average is approximately 7%. Hillsborough County terminal harvests are similar to those in Rockingham and Strafford Counties.

**Figure 23**



*Source: SPNHF NH's Vanishing Forests, 2001*

### **CRITERION 3:**

## **Maintenance of Forest Ecosystem Health and Vitality**

### ***6. Area of forest land affected by potentially damaging agents***

Damage to our forests can come in the form of insect pests, invasive plants, ice storms or wildfire. In some instances this is a normal part of nature and considered an agent of change. However, at larger scales these forces can negatively impact the suite of goods and services we rely on from our forests. As an example a wind storm might blow down a mature crop of white pine causing a financial loss to the landowner. Or perhaps, a hemlock stand that is prime deer habitat is destroyed by hemlock wooly adelgid. To this end the Division of Forests and Lands monitors the State's forest annually in an effort to detect these problems in the early phases.

While not considered significant compared to other stressors, it is important to understand the extent to which wildfire affects the forested landscape in New Hampshire. Wildfires affect between 100 and 1000 acres annually over the last 20 years. Some peak years in the mid-1990s appear to be spike years. Given the climate and forest cover, New Hampshire and the surrounding northeastern states are simply not going to be affected by wildfire like other regions of the country. The Forest Protection Bureau is working with local fire departments and communities to always be prepared. The division offers training programs and aids in the development of Community Wildfire Protection Plans. Ten New Hampshire communities have developed Community Wildfire Protection Plans

**Table 4** shows the damaging insect found in 2009 surveys by the Division of Forests and Lands. Oak Leafroller in western New Hampshire was the primary damaging causing agent. Hemlock wooly adelgid, has become a significant threat, spreading throughout NH despite suppression efforts.

**Table 4 - 2009 Biotic Stressors on NH Forests**

Biotic Stressor	2009 Damage	Area Affected
<b>Oak Leafroller</b>	8,327 Acres	Western
<b>Birch dieback</b>	656 Acres	Statewide
<b>Leaf spots</b>	308 Acres	Ossipee
<b>Pine gall weevil, and bark beetles</b>	56 Acres	Scattered throughout state
<b>Beech bark disease</b>	32 Acres	Scattered throughout state
<b>Balsam woolly adelgid</b>	88 Acres	Damage generally below 2000 feet elevation.
<b>Hemlock wooly adelgid</b>	New infestations found in 4 communities, reported by homeowners in 2 additional	Primarily southern & coastal NH

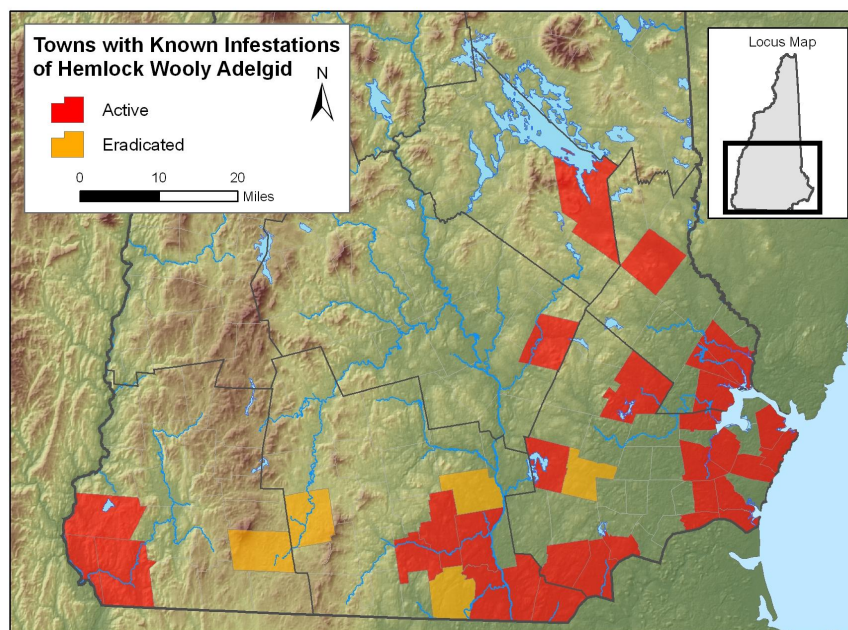
*Source: USDA Forest Service 2009 Forest Health Highlights NH*

**Figure 25**, a map of biotic and abiotic forest stressors found in 2009 aerial surveying by the Division of Forests & Lands is especially helpful in understanding the full range of biotic and abiotic stressors. Not included, but clearly of huge consequence, are the acres being converted from forest to non-forest use as development continues its march in the Granite State.

One of the biggest threats to the health of our forest is the introduction of non-native insects and diseases. In 1900, there were a handful of exotic insects and diseases in North America. Today, there are more than 500 exotic, invasive insects and diseases impacting forests of the United States.

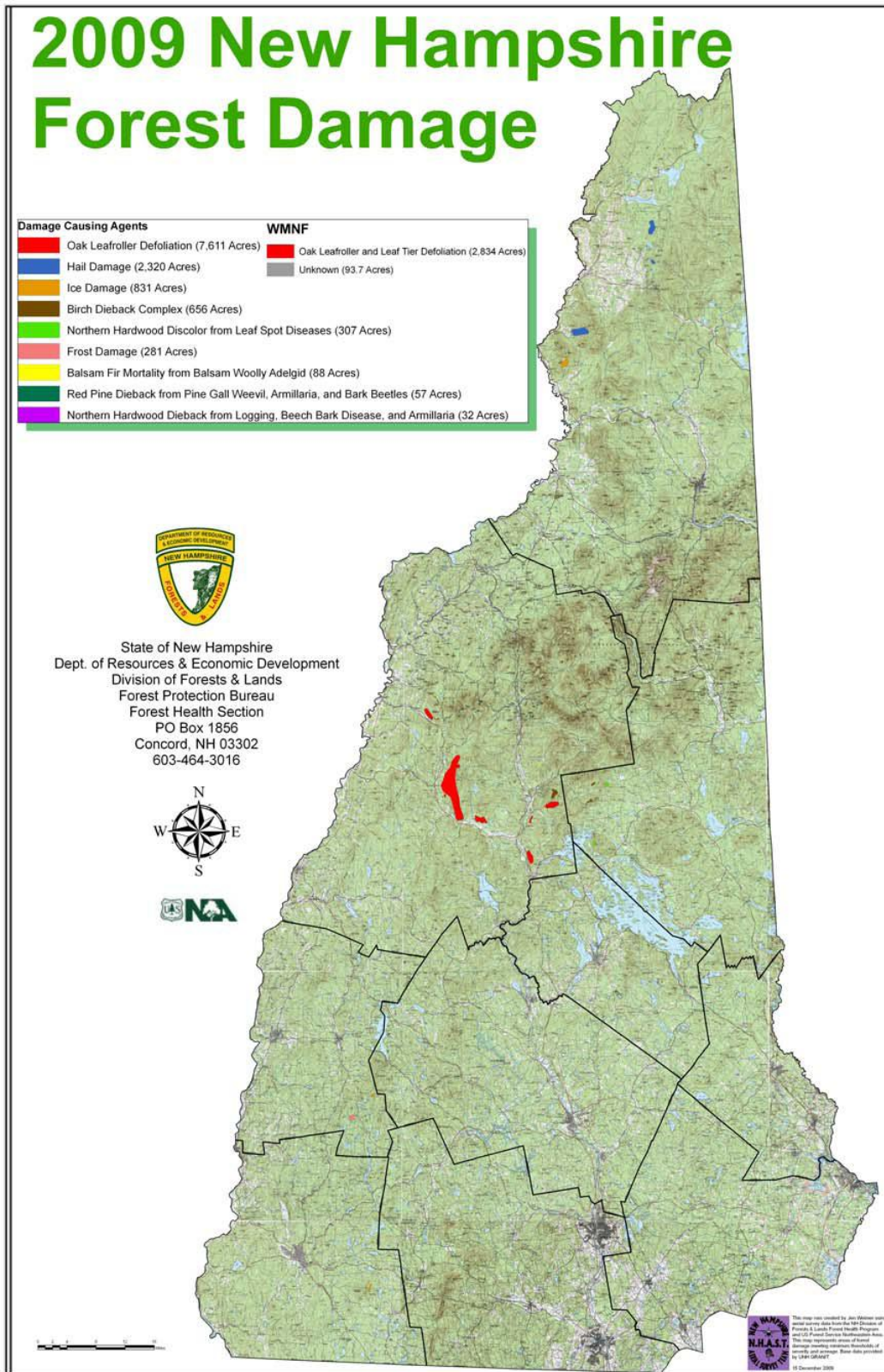
The ecological, social and economic damage invasive exotics have already caused is extensive, and the potential for more lingers. With expanding world-wide trade and transport (50% of the toys sold in the U.S come from China) natural barriers like oceans, deserts, and trade winds are no longer restricting the movement of damaging insects and diseases. The global economy has given pests the opportunity to establish populations where there is little genetic resistance within host trees and no native biological controls. Examples from the past are the Chestnut Blight and Dutch Elm Disease. Each of these diseases has virtually eliminated respective host species as a major component of the eastern forest. Examples of exotic insects currently found in NH forests include Gypsy moth, Hemlock wooly adelgid(**Figure 26**), Balsam wooly adelgid, and Winter moth. Of these pests, Hemlock wooly adelgid is considered the most destructive. There are active outbreaks in several New Hampshire towns however, some isolated outbreaks have been eradicated. Unfortunately, there is no native means of control and large scale use of pesticides or other treatments are not a realistic defense.

**Figure 26**



The number of exotic invasive pests moving toward New Hampshire's forest continues to grow. Pests at high risk of invading our forests include the Emerald ash borer, Asian long-horn beetle, Sudden Oak death, Oak wilt, the Asian gypsy moth, Browntail moth and most recently the Sirex woodwasp. These pests all share the common trait of being aggressive killers of tree species found in New Hampshire and there are no natural controls in our ecosystem. Specifically, the Asian long-horn beetle was discovered in Worcester, MA in 2008. Efforts to eradicate this pest have been extensive. All host trees in the area have been removed and chipped or chemically treated and landowners can request to have new trees planted. The cost of this specific outbreak is tens of millions of dollars however, the economic and environmental cost would be devastating if left unchecked.

Figure 25



## **CRITERION 4:**

### **Conservation and Maintenance of Soil and Water Resources**

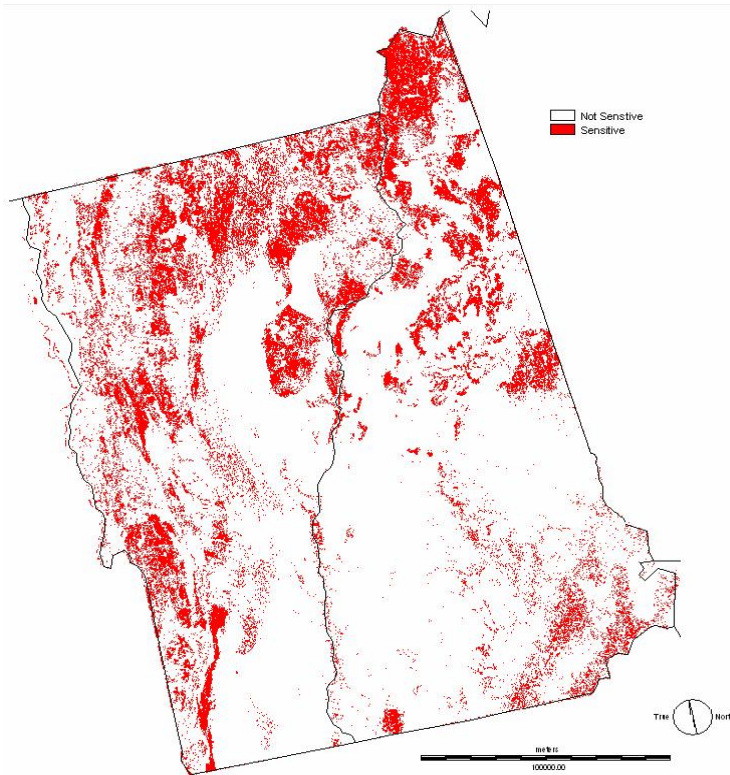
#### ***7. Soil quality on forest land***

Forest soil quality data is not easy to come by on a statewide basis but there are some key metrics that help tell the story of New Hampshire's forest soils for today and give us a sense of their potential for the future.

The Appendix under this section contains some helpful baseline information relative to soil Ph, carbon and bulk density<sup>5</sup>. These data will be helpful in comparing future data when the next Forest Resources Plan is developed. A more useful set of data is from a recent report from the Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group in a December 2005 publication entitled: *Assessment of Forest Sensitivity to Nitrogen and Sulfur Deposition in New Hampshire and Vermont*. A series of maps tell an interesting story about New Hampshire's soils and their vulnerability to change.

**Figure 27** shows that certain areas of New Hampshire are particularly sensitive to nitrogen and sulfur deposition. The North Country and high elevation areas in particular are very sensitive given generally

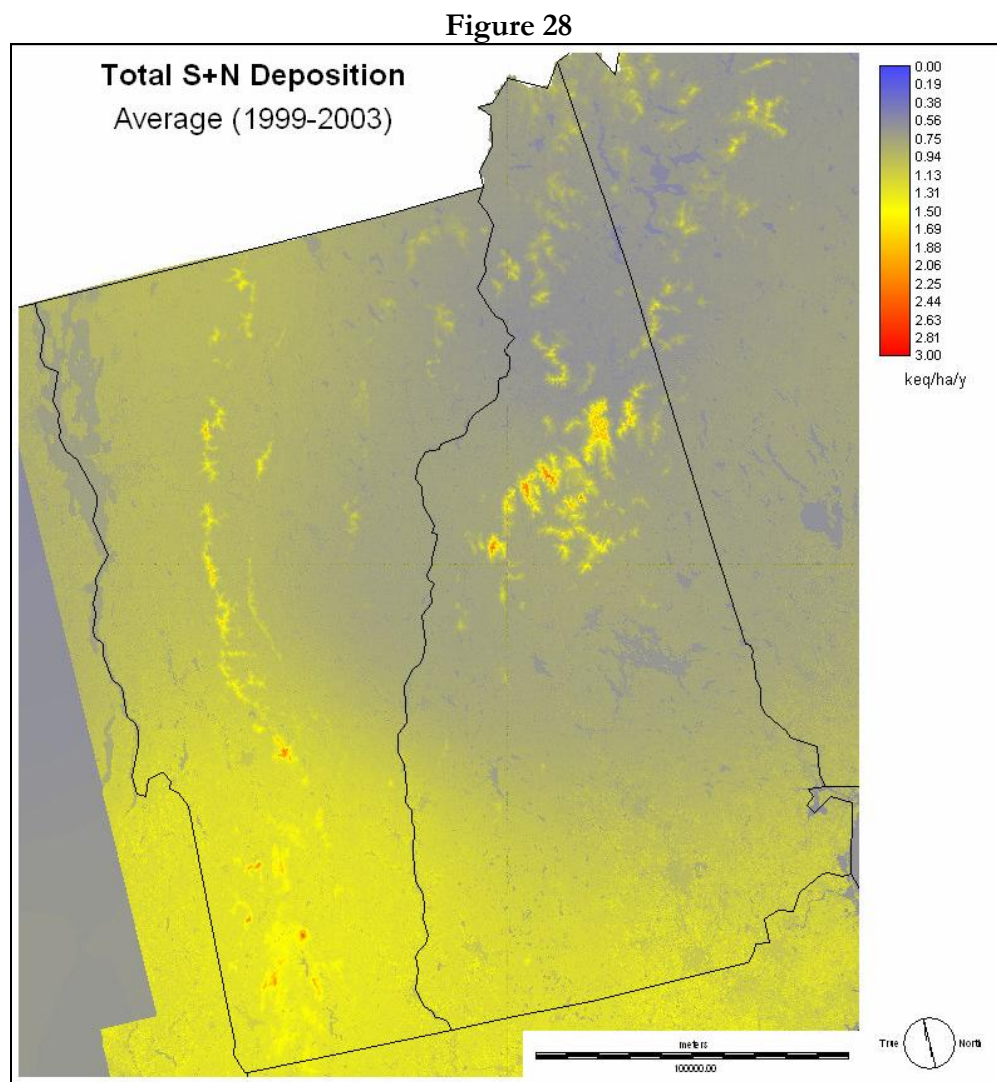
**Figure 27**  
**Soils Sensitive to Sulfur and Nitrogen Deposition 2005 – 18% of NH is Sensitive**



*Source: Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group*

<sup>5</sup> All from USDA Forest Service Forest Inventory and Analysis  
New Hampshire Forest Resources Plan Revision  
Assessment Report – 2006; Updated - 2010

thinner soils. **Figure 28** shows that most of the higher deposition rates for nitrogen and sulfur tend to be at higher elevations - areas very sensitive to this deposition. The concern here is one of future soil productivity. Excess sulfur and nitrogen deposition may reduce the supply of nutrients available for plant growth. Nutrient depletion leads to increases in the susceptibility of forests to climate, pest and pathogen stress which results in reduced forest health, reduced timber yield, and eventual changes in forest species composition<sup>6</sup>.

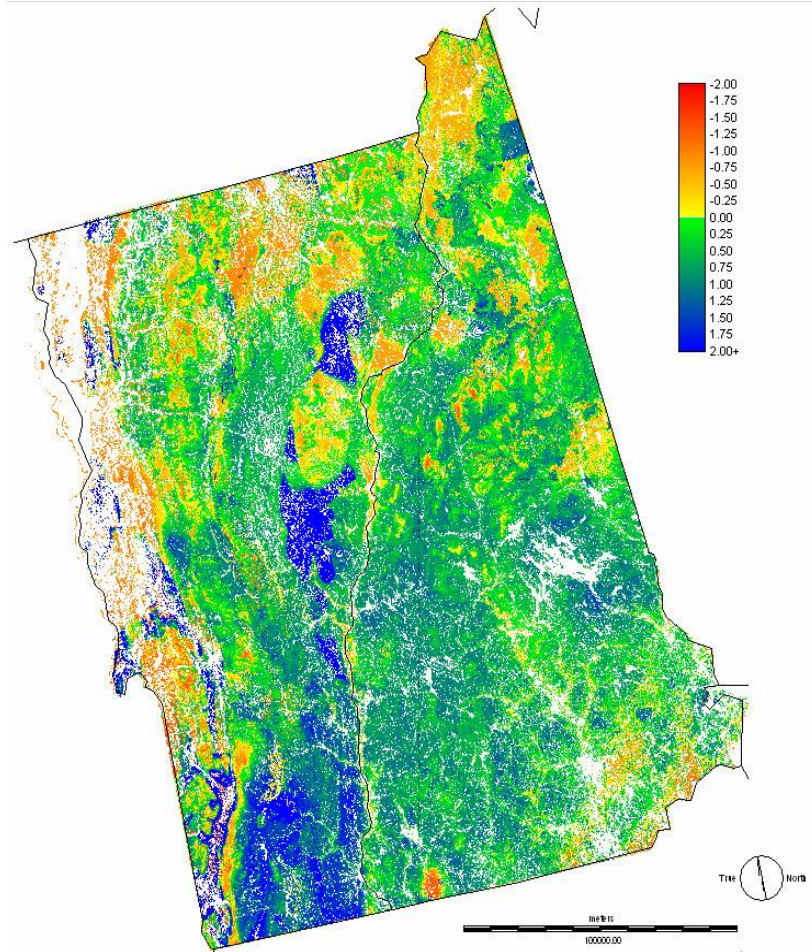


Source: Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group

**Figure 29** further describes the sensitivity of New Hampshire to deposition while **Table 6** shows that hardwoods are particularly sensitive to nitrogen and sulfur deposition.

<sup>6</sup> *Assessment of Forest Sensitivity to Nitrogen and Sulfur Deposition in New Hampshire and Vermont*

**Figure 29** – The deposition index for atmospheric sulfur and nitrogen deposition to New Hampshire and Vermont (1999 – 2003) with respect to forest ecosystem critical loads. Positive values of the deposition index reflect the capacity of a forest ecosystem to tolerate additional acidic deposition. Negative values of the index correspond to the reduction in S & N deposition required to eliminate present or deter the development of nutrient limitations. Red-orange-yellow areas indicate current sulfur and nitrogen atmospheric deposition rates greater than the critical load. The deposition index is expressed in terms of kilo-equivalents of charge per hectare per year. Nitrogen deposition includes both ammonium + nitrate forms. White areas are non-forested land or water.



**Table 5**  
**Forest Sensitivity to Acid Deposition by Forest Type in NH**

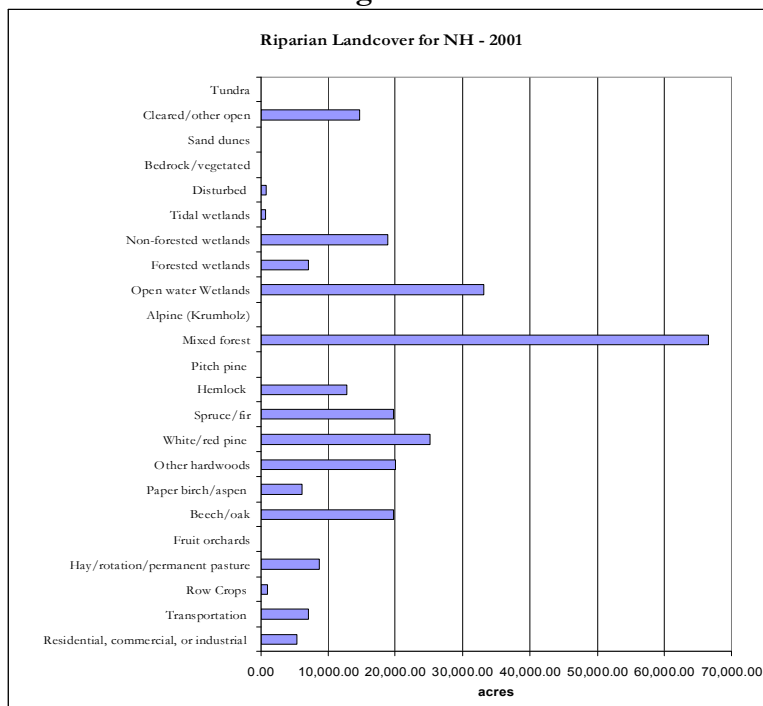
Forest Type	% of Forest Area	% Sensitive (of forest area)
Mixed Evergreen and Deciduous	20.1%	7.9%
Northern Hardwoods	18.9%	2.1%
Hemlock, Red Spruce, Balsam Fir	14.8%	10.4%
Sugar Maple - Northern Hardwoods	11.4%	39.8%
Balsam Fir, Red Spruce, Northern Hardwoods	7.9%	26.6%
Central Hardwoods	6.1%	49.6%
Balsam Fir, Red Spruce	5.9%	27.4%
White Pine, Hemlock, Central Hardwoods	3.3%	13.3%
White Pine, Hemlock, Red Spruce	3.1%	13.3%
Balsam Fir, Red Spruce, Birch	2.6%	18.0%
White Pine, Central Hardwoods	2.1%	25.1%
White Pine	2.0%	1.0%
Birch, Northern Hardwoods	1.9%	50.4%
<b>All Forest</b>	<b>100.9%</b>	<b>17.6%</b>

*Source: Conference of New England Governors and Eastern Canadian Premiers Forest Mapping Group*

## 8. Area of forest land adjacent to surface water, and forest land by watershed

While increasingly New Hampshire's riparian areas are under development pressure, understanding the land base associated with the immediate zone adjacent to rivers, lakes and great ponds in the state is helpful since degradation of these lands may have a particularly negative effect on riparian ecosystems. **Figure 30** uses GIS data from Complex Systems at UNH to understand what kind of land is found within 30 meters of waterbodies. Surprisingly, this corridor is dominated by undeveloped uses. This is an important finding, but represents only one point in time. It will be especially helpful to run this kind of analysis in 10 years when the next forest plan is developed.

**Figure 30**



Complex Systems Research Center, University of New Hampshire. 2002. *New Hampshire Land Cover Assessment - 2001, 30 meter riparian area.*

## 9. Water quality in forested areas

The Environmental Protection Agency analysis of water quality in New Hampshire is generally considered a thorough and reliable indication of the state's water quality. **Figure 31** contains a series of tables designed to describe the level of impairment to water bodies in New Hampshire. These analyses give an insight into what threats exists to the state's waters – both moving (rivers and streams) and standing (lakes and ponds) waters.

**Figure 31**

### New Hampshire Assessed Waters Individual Use Support for Rivers and Streams

State Designated Use	Total Miles Assessed	Percent Good	Percent Threatened	Percent Impaired	<div style="display: flex; justify-content: space-between; width: 100px;"> <span><span style="width: 33%; height: 10px; background-color: #008080;"></span> % Good</span> <span><span style="width: 33%; height: 10px; background-color: #ffff00;"></span> % Threatened</span> <span><span style="width: 33%; height: 10px; background-color: #ff0000;"></span> % Impaired</span> </div>
Fish, Shellfish, and Wildlife Protection and Propagation	766.52	.00	1.60	98.40	<div style="width: 98.4%; height: 10px; background-color: #ffff00;"></div>
Recreation	1,233.57	66.32	.00	33.68	<div style="width: 66.32%; height: 10px; background-color: #008080;"></div>
Public Water Supply	334.89	100.00	.00	.00	<div style="width: 100%; height: 10px; background-color: #008080;"></div>
Aquatic Life Harvesting	9,606.91	.00	.00	100.00	<div style="width: 100%; height: 10px; background-color: #ffff00;"></div>

**New Hampshire Top Probable Sources of Impairments  
for Rivers and Streams**

#	State Source Name	Total Miles Impaired by Source
1	ATMOSPHERIC DEPOSITON - TOXICS	9,605.90
2	SOURCE UNKNOWN	1,038.73
3	COMBINED SEWER OVERFLOWS	49.50
4	ILLICIT CONNECTIONS/HOOK-UPS TO STORM SEWERS	32.23
5	INDUSTRIAL POINT SOURCE DISCHARGE	27.32
6	LANDFILLS	27.21
7	MUNICIPAL POINT SOURCE DISCHARGES	25.97
8	LIVESTOCK	8.01
9	IMPACTS FROM HYDROSTRUCTURE FLOW REGULATION/MODIFICATION	6.86
10	ACID MINE DRAINAGE	5.25

**New Hampshire Top Causes of Impairments  
for Rivers and Streams**

#	State Cause Name	Total Miles Impaired
1	MERCURY	9,606.91
2	PH	613.81
3	ESCHERICHIA COLI	415.41
4	POLYCHLORINATED BIPHENYLS	176.05
5	OXYGEN, DISSOLVED	109.12
6	NON-NATIVE AQUATIC PLANTS	34.21
7	DISSOLVED OXYGEN SATURATION	28.06
8	LEAD	26.33
9	IRON	21.53
10	COPPER	18.49

**New Hampshire Assessed Waters  
Individual Use Support for Lakes, Ponds, and Reservoirs**

State Designated Use	Total Miles Assessed	Percent Good	Percent Threatened	Percent Impaired	<div> <div></div> % Good <div></div> % Threatened <div></div> % Impaired </div>
Fish, Shellfish, and Wildlife Protection and Propagation	85,511.96	.00	.01	99.99	<div> <div></div> </div>
Recreation	98,783.81	98.95	.00	1.05	<div> <div></div> </div>
Public Water Supply	13,991.23	95.58	.00	4.42	<div> <div></div> </div>
Aquatic Life Harvesting	187,728.66	.00	.00	100.00	<div> <div></div> </div>

**New Hampshire Top Causes of Impairments  
for Lakes, Ponds and Reservoirs**

#	State Cause Name	Total Acres Impaired
1	MERCURY	187,728.66
2	NON-NATIVE AQUATIC PLANTS	70,466.97
3	PH	14,878.87
4	POLYCHLORINATED BIPHENYLS	14,719.90
5	COPPER	2,000.00
6	ESCHERICHIA COLI	988.03
7	EXCESS ALGAL GROWTH	618.80
8	DISSOLVED OXYGEN SATURATION	508.00
9	ALUMINUM	485.50
10	DIOXIN (INCLUDING 2,3,7,8-TCDD)	384.10

**New Hampshire Top Probable Sources of Impairments  
for Lakes, Ponds and Reservoirs**

#	<u>State Source Name</u>	<u>Total Acres Impaired by Source</u>
1	ATMOSPHERIC DEPOSITON - TOXICS	187,728.66
2	SOURCE UNKNOWN	86,502.37
3	ATMOSPHERIC DEPOSITON - ACIDITY	10,005.69
4	NATURALLY OCCURRING ORGANIC ACIDS	4,171.18
5	COMBINED SEWER OVERFLOWS	562.00
6	MUNICIPAL (URBANIZED HIGH DENSITY AREA)	389.50
7	INDUSTRIAL POINT SOURCE DISCHARGE	386.10
8	TRANSFER OF WATER FROM AN OUTSIDE WATERSHED	245.40
9	ILLICIT CONNECTIONS/HOOK-UPS TO STORM SEWERS	238.50
10	MUNICIPAL POINT SOURCE DISCHARGES	59.00

*Source for all of 10.1: Environmental Protection Agency, Water Quality Assessment Data for the State of New Hampshire Year 2002*

These data, and the subsequent analysis showing sources of pollution, suggest that forestry and forest recreation are not significant contributors to water quality degradation. Airborne pollutants (much from sources far away such as the mid-western coal-fired power plants), along with the activities associated with development such as septic systems, run-off on non-natural surfaces and industrial pollutants, lead the list.

## **CRITERION 5:**

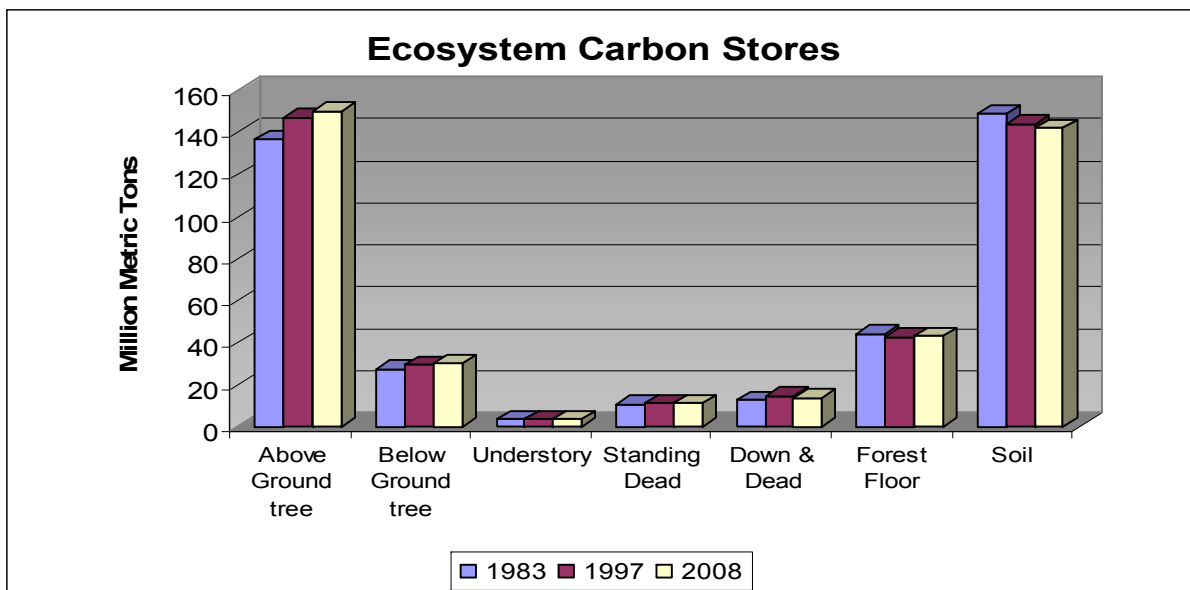
### **Maintenance of Forest Contribution to Global Carbon Cycles**

#### ***10. Forest ecosystem biomass and forest carbon pools***

The role of forest-based carbon and carbon markets remains unclear. In the northeastern U.S., discussions are focusing on reducing carbon dioxide emissions from power plants and other airborne emitters. Under the Regional Greenhouse Gas Initiative (RGGI), northeast U.S. state government air regulators are developing a plan to do that – subject to approval by the legislatures in each state. Forest carbon offsets may be a small part of the recommendations associated with RGGI but the major component is likely to be smokestack emission reductions.

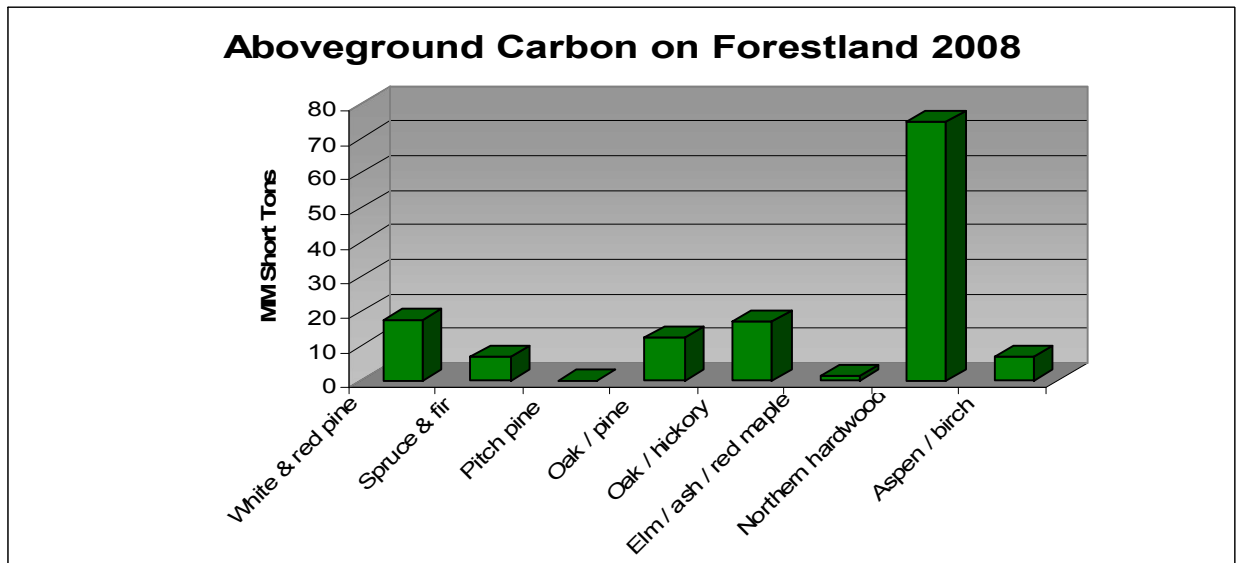
**Figure 32** shows that tree biomass and, thus, carbon stores, are increasing in every category related to trees, however, both forest floor and soil carbon are to be declining. Above ground live tree biomass and soil carbon dominate the categories. **Figure 33** breaks this down by species group. Given that northern hardwood volume is the largest of all species group categories (earlier figures) it comes as no surprise that the most carbon is stored in these species as well.

**Figure 32**



Source : Heath, L USDA Forest Service

Figure 33



*Source: USDA Forest Service FLA*

If the role of tree carbon becomes more important in carbon offset programs or markets, New Hampshire's increasing biomass tree stores could play a role in the future and both landowners and the public may be the beneficiaries. Since a significant amount of forest-related carbon is found in forest-soils<sup>7</sup> (rather than tree boles, branches and leaves or underground woody material), intact forests could become an important factor in this increasingly important issue. Soil carbon stores in NH in 2008 were estimated at 142,240,000 metric tons<sup>8</sup>.

<sup>7</sup> Heath, Linda. Research Forester, USDA Forest Service, various publications on carbon offsets from forests.

<sup>8</sup> Heath, Linda. Research Forester, USDA Forest Service, various publications on carbon offsets from forests.

## **CRITERION 6:**

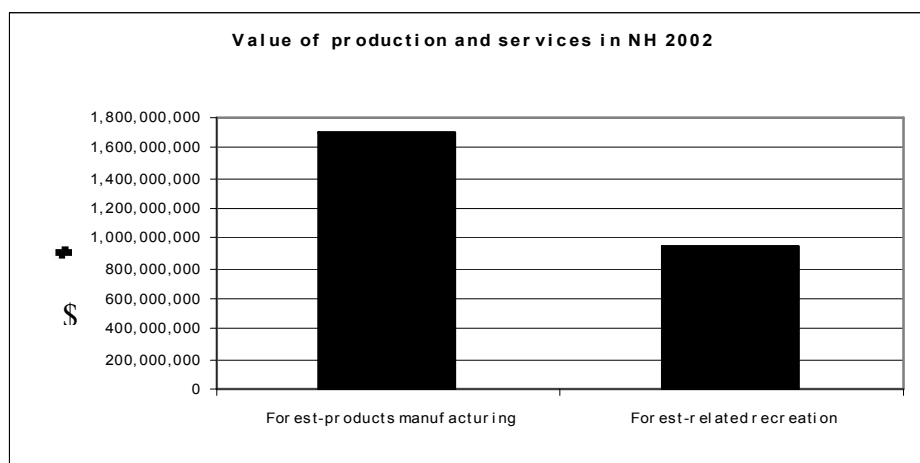
### **Maintenance and Enhancement of Long-term Multiple Socio-economic Benefits to Meet the Needs of Societies**

#### ***11. Wood and wood products production, consumption, and trade***

The forests of New Hampshire provide many different benefits to citizens and visitors. One key suite of benefits falls into the category of economics. The forests of the state are integral to the economy of New Hampshire from both the timber and forest products and recreation/tourism portions of the equation.

The value of the combined forest products manufacturing and forest-related recreation industries in NH is \$2.6 billion annually (**Figure 34**). Of this, forest-based manufacturing is \$ 1.7 billion annually while forest related recreation and tourism adds another \$ 940 million each year. The closure of the pulp mill in Berlin in May of 2006 reduced the annual economic output for the state by \$ 114 million. The start-up of the Schiller biomass energy facility in Portsmouth has made up for about \$ 30 million of that loss.

**Figure 34**

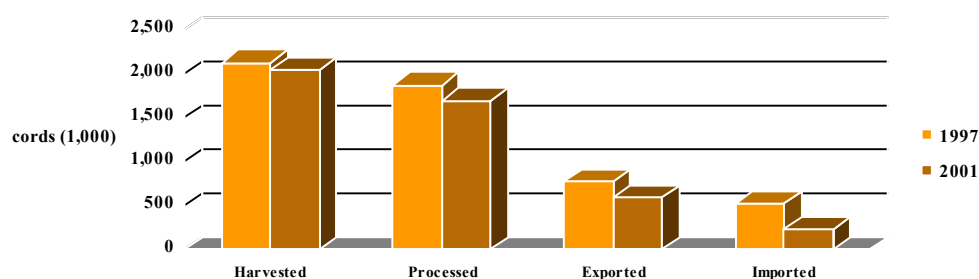


*Source: NEFA and U.S. Census*

**Figure 35** shows the 1997 and 2001 harvesting output and manufacturing balance. Approximately 80% of the wood harvested in the state is processed here.

Figure 35

### NH Timber Harvested and Flows 1997 & 2001

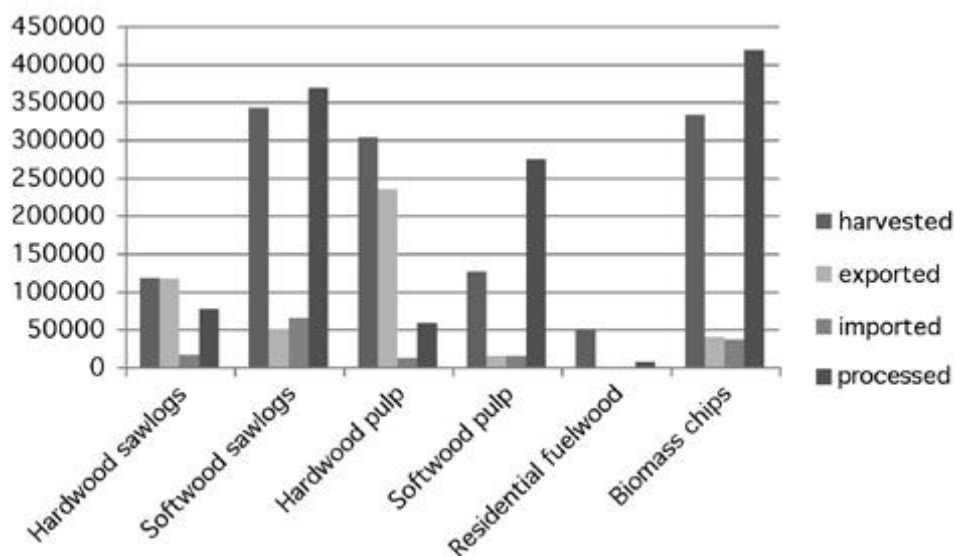


Source: NEFA

Timber harvests on all lands (state, federal or private) bring 1.2 to 1.4 million cords of wood to market annually. In 2006, 70.1 million board feet<sup>3</sup> of hardwood sawlogs and 162.5 million board feet of softwood sawlogs were harvested from the forests of New Hampshire. In that same year, 485 thousand cords pulpwood were harvested in the State. Over 859,000 green tons of whole tree chips were harvested in 2006 as well. The estimated value of these timber sales ranges from \$30 to \$50 million. **Figure 36** shows the flows of wood from the major categories of wood harvested – all calibrated in cords for easy comparison.

Figure 36

### Wood Flows in New Hampshire 2005



Source: NEFA

**Table 6** shows the status of the wood-fired power plants in New Hampshire. Of the original eight plants built in the 1980s, three have been closed (Bio-Energy, Alexandria & TIMCO) while four of the remaining five plants (Pinetree Bethlehem, Pinetree Tamworth, Hemphill and Bridgewater) all face expiring rate-orders<sup>9</sup>

<sup>9</sup> Rate-orders – are essentially long term contracts for selling power to a utility.

beginning in 2006. Whitefield Power had its rate-order bought out and is operating in the open market due in large part because of investments made to qualify for the Renewable Portfolio Standard (RPS) in Connecticut. An RPS is public policy requiring use of renewable power in the regional market, and provides a price premium to power generators who can meet certain environmental standards with their power generation<sup>10</sup>. Public Service Company of New Hampshire has opened its new Schiller wood energy plant in Portsmouth, NH (a retro-fit of a coal-fired boiler). This plant, at 50 Megawatts, is more than double the size of any of the existing wood-fired plants. It will use approximately 450,000 tons of wood chips per year. Currently, there are two facilities vying for site aproval in the town of Berlin. One will produce steam and 29 Megawatts of electricity, the other will be produce between 60 and 70 Megawatts of electricty. It remains to be seen which facility will be sited and when in will be operational.

**Table 6**

<b>New Hampshire Wood-Fired Electric Generating Plants</b>			
<b>Plant and Location</b>	<b>Size (MW)</b>	<b>Annual Wood Consumption (tons/yr)</b>	<b>Status</b>
Bio Energy – Hopkinton <b>(CLOSED)</b>	11	146,000	Rate order bought out 11/2001; tried to operate on C&D – state ban imposed 2005
Bridgewater Power – Bridgewater	15	229,000	Rate order expires 8/31/2007
Hemphill Power & Light – Springfield	13.8	208,000	Rate order expires 11/30/2007
Pinetree Power – Bethlehem	15	227,000	Rate order expires 11/30/2006
Pinetree Power – Tamworth	20	286,000	Rate order expires 3/31/2008
Whitefield Power & Light – Whitefield	13.8	187,000	Rate order bought out 11/2001; expects to continue operating for 1-3 years
Alexandria Power – Alexandria <b>(CLOSED)</b>	15	225,000	Rate order bought out mid-1994; restrictions on future power sales
Timco – Pittsfield <b>(CLOSED)</b>	4	55,000	Rate order bought out 1994; restrictions on future power sales
Public Service Company of NH – Schiller, Portsmouth	50	450,000	Coal plant retrofit

*Source: Existing and Potential Markets for Low-grade Wood in NH, 2002- updated*

## **12. Outdoor recreational facilities and activities**

A 1997 study at UNH determined the level of participation from NH households and individuals in various recreational activities (**Table 7**). Top household activities included (in order):

- wildlife observation
- driving for pleasure
- sightseeing
- jogging/running/walking
- dayhiking
- stream/river/lake swimming

<sup>10</sup> Renewable Portfolio Standards allow the trading of Renewable Energy Certificates (RECs) representing the renewable power generated from these facilities. As a result, the REC qualified power provider sells both electricity and RECs – hence the price premium.

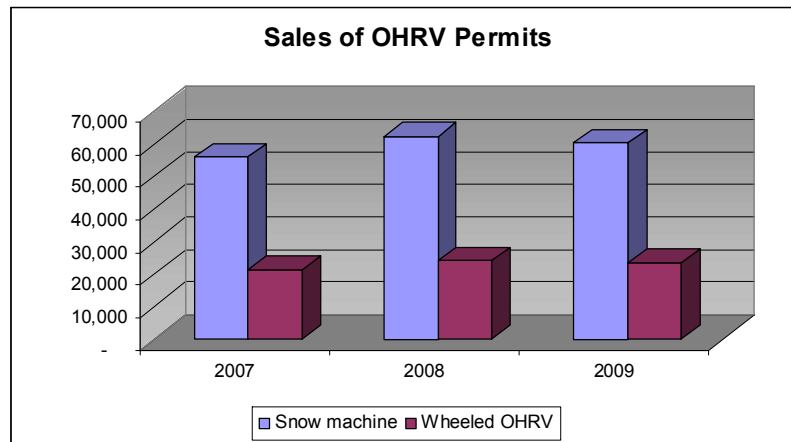
Table 7

<b>NEW HAMPSHIRE PARTICIPATION RATES AND FREQUENCY OF PARTICIPATION</b>			
	<b>Overall Household Participation</b>	<b>Percent who participate 1-6 times a year</b>	<b>Percent who participate 7 + times a year</b>
Wildlife Observation	85%	35%	50%
Driving for Pleasure	84%	32%	52%
Sight-seeing	84%	45%	39%
Jogging/Running/Walking	79%	17%	62%
Day Hiking	73%	48%	29%
Stream/Lake Swimming	71%	37%	34%
Picnicking	68%	49%	19%
Photography	64%	37%	27%
Ocean Swimming	58%	40%	18%
Bicycling	55%	29%	26%
Outdoor Pool Swimming	54%	26%	28%
Freshwater Fishing	50%	23%	27%
Nature Study	47%	33%	14%
Canoeing/kayaking/rowing	45%	33%	12%
Motor-boating	43%	23%	20%
Playing on playgrounds	40%	20%	20%
Tennis/Volleyball/Golf	37%	16%	21%
Baseball/basketball/soccer	36%	14%	22%
Downhill Skiing	35%	17%	18%
Camping in National Forest	33%	30%	3%
Camping at State Parks	31%	26%	5%
Cross-country skiing	31%	20%	11%
Backpacking	29%	24%	5%
Camping at Private Campground	28%	21%	7%
Mountain biking	27%	15%	12%
Large Game Hunting	25%	10%	15%
Off-road Vehicle Driving	21%	13%	8%
Snowshoeing	20%	13%	7%
Snowmobiling	19%	9%	10%
ATV	17%	6%	11%
Bird Hunting	17%	9%	8%
Water skiing	17%	11%	6%
Horseback Riding	15%	10%	5%
Sailing	14%	10%	4%
Sea Kayaking	4%	3%	1%

Source: NH Outdoor Needs Assessment (UNH)

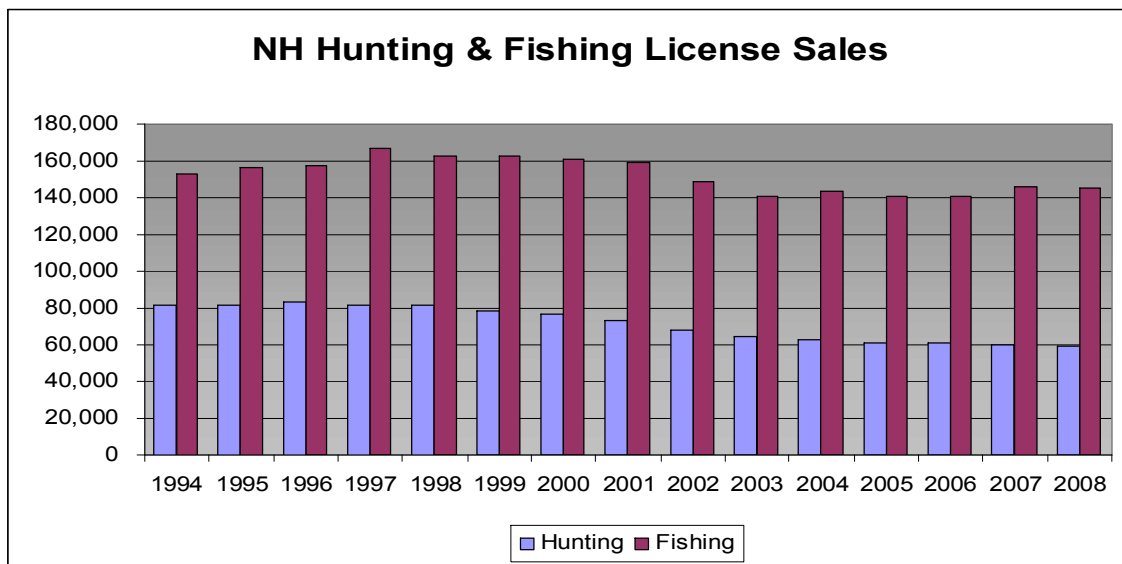
Interestingly, snowmobiling and ATV riding ranked toward the bottom of the list though these activities require significant investment. Snowmobiling is worth \$ 367 million per year to the NH economy according to a study commissioned by the NH Snowmobile Association in 2001. Snowmobile sales nationally peaked nationally in 1997 at 260,735 units and were at 208,592 units in 2001. New Hampshire OHRV registrations (**Figure 37**) have been ranged from 50 to 60,000 in-state registrations and approximately 25,000 out-of-state registrations in recent years.

Figure 37



Hunting and fishing activities have been declining, as measured by sale of hunting and fishing licenses. **Figure 38** shows the last 15 years of sales. Hunting license sales peaked in 1996 at about 83,000 licenses and stand at about 59,000 in 2008. Fishing license sales peaked in 1997 at just under 167,000 and are currently at about 145,000 licenses. The sales of licenses are integral to the mission of the NH Fish & Game Department which is a self-funded agency. License sale make up a significant portion of its operating budget.

Figure 38



Source: NH Fish & Game Department

**Table 8** shows current use assessment<sup>11</sup> acres in NH by county. The 2,919,339 acres in current use represent over 51% of the land area in the state. Of this, over 48% is enrolled in the 20% recreational

<sup>11</sup> Current use land is privately held undeveloped land voluntarily enrolled in a state-based reduced assessment program that significantly reduces property taxes on these lands if they are kept in their undeveloped state.

discount option whereby the landowner agrees not to post his/her land against passive recreational access.

Table 8

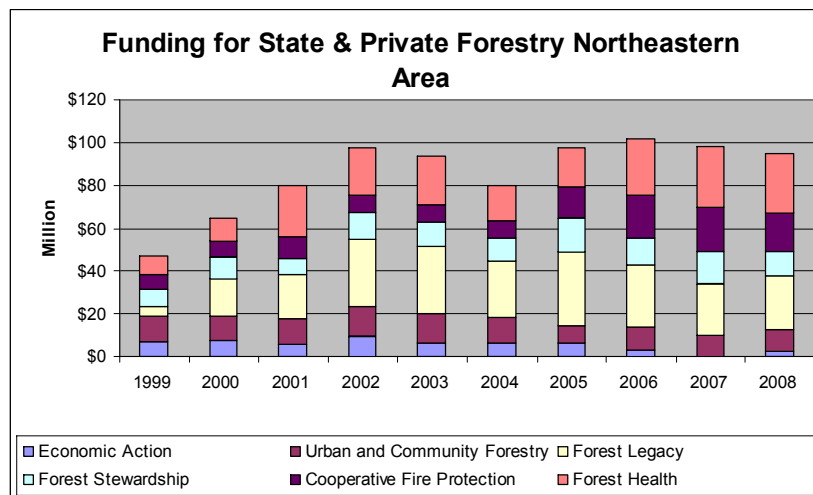
2009 CURRENT USE REPORT					
STATE SUMMARY: 20% RECREATIONAL ADJUSTMENT					
COUNTY	Land Area Acres	Current Use Area Acres	% Area in Current Use	Acres with 20% Recreation Adj.	% Area with 20% Recreation Adj.
BELKNAP	257,726	137,882	53%	55,813	40%
CARROLL	598,387	224,616	38%	108,688	48%
CHESHIRE	452,911	292,631	65%	90,029	31%
COOS	1,152,947	693,544	60%	555,424	80%
GRAFTON	1,096,323	481,794	44%	204,574	42%
HILLSBOROUGH	561,351	256,266	46%	76,730	30%
MERRIMACK	597,481	333,542	56%	135,702	41%
ROCKINGHAM	446,221	149,293	33%	31,589	21%
STRAFFORD	235,093	114,173	49%	44,735	39%
SULLIVAN	344,219	235,598	68%	100,468	43%
<b>TOTALS</b>	<b>5,742,659</b>	<b>2,919,339</b>	<b>51%</b>	<b>1,403,751</b>	<b>48%</b>

Source: New Hampshire Department of Revenue Administration

### 13. Investments in forest health, management, research, and wood processing

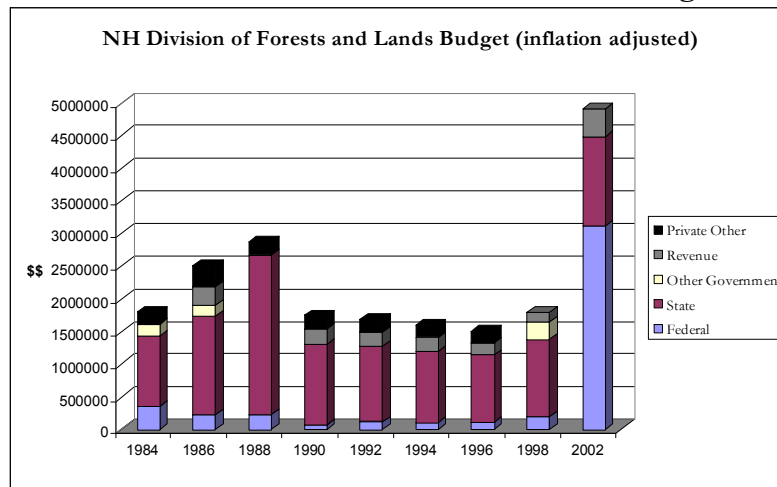
Federal and state tax dollar appropriations are important sources of revenue for state and federal agencies in the business of forest health, management and research. **Figure 39** shows that overall federal appropriations for these purposes through the myriad of programs has declined from a recent peak in 2006. **Figure 40** shows the NH Division of Forests and Lands budgets (inflation adjusted) for recent years. Here too, a general decline has occurred since a peak of state appropriated dollars in 1988.

Figure 39



Source: USDA Forest Service

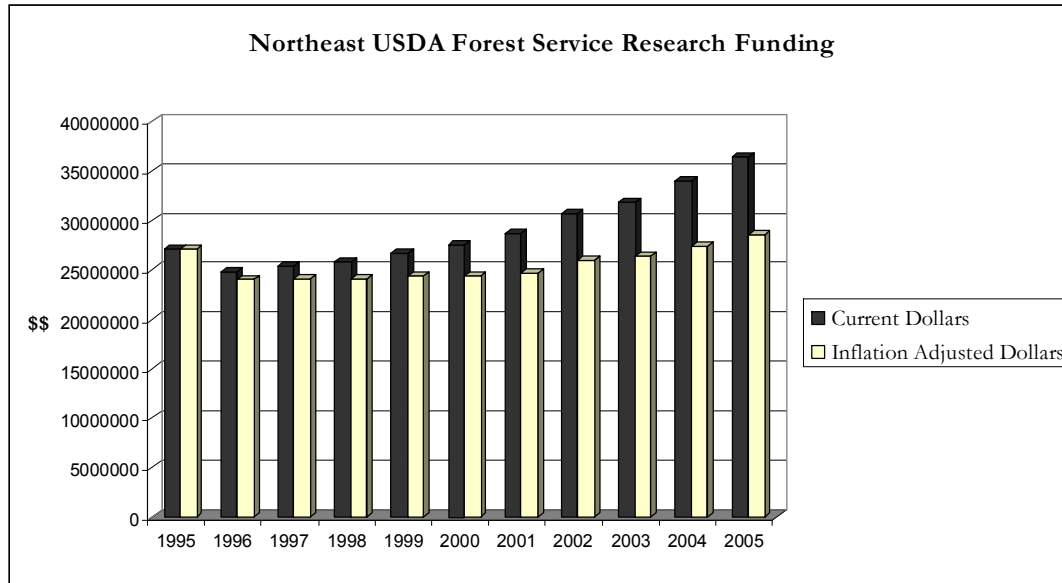
**Figure 40**  
**NH Division of Forests & Lands funding**



*Source: agency (Note: large 2002 federal revenue from Forest Legacy program – Conn. Lakes)*

USDA Forest Service research funding for the northeast region of the US has increased since a low in 1996. **Figure 41** shows this to be true even if we view the numbers in inflation-adjusted dollars.

**Figure 41**  
**USDA Forestry Research Funding – Northeast Region**

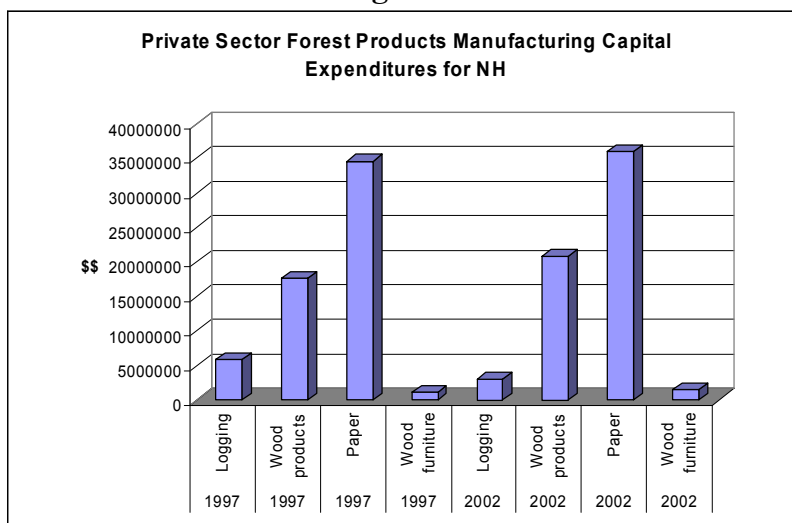


*Source: USDA Forest Service, Research and Development*

Capital expenditures in any manufacturing industry is a good measure of health since these are long-term investments seeking returns over a long period into the future. **Figure 42** shows forest products manufacturing investment in NH in 1997 and 2002. A general increase occurred during this period with investment in wood products (sawmills) and pulp and paper in 2002 topping \$ 35,000,000.

Given recent closure of pulp and paper facilities in Groveton and Berlin, we can expect investments in this sector to decline though there are still paper manufacturing facilities in both locations.

**Figure 42**



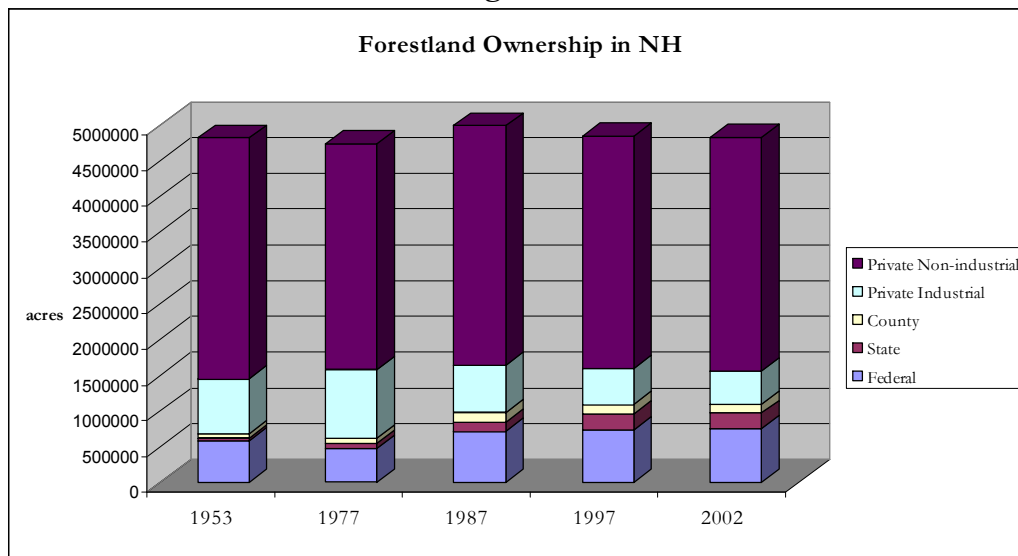
*Source: USDA TPO survey*

#### **14. Forest ownership, land use, and specially designated areas**

Forestland ownership trends in New Hampshire are similar to other states in the region. The largest change in recent years is the shift from industrial forest owners (those companies whose lands are part of a company structure that includes forest products manufacturing such as pulp and paper) to non-industrial ownership – primarily Timber Management Investment Organizations using private investor money for somewhat term-limited investments, generally 7 – 10 years, in timberland for profit.

**Figure 43** shows that this phenomenon has resulted in more than a two-thirds reduction in industrial forestland ownerships (most in Coos, Grafton and Carroll counties) from 1977 to present. Public lands (state and federal) have seen a slight increase during this period – largely as part of some of the sales of the former industrial timberland.

Figure 43



Source: USDA FIA and National Woodland Owner Survey

Since the last Forest Resources Plan, the forest certification phenomenon has taken hold in North America and the world. Forest certification is a system whereby a private forest sustainability standard is measured on a particular forest ownership by an independent third-party auditor. If the property meets the standard then it becomes “certified” under that program’s system. The thinking about forest certification in the early 1990s was that it would result in price premiums for forest landowners and manufacturers and that this market phenomenon would drive the efforts. In reality, few market premiums are found. Certification is, however, becoming a market entrance requirement for some markets or market preference, with no prices premium, is being given in some cases.

The two major forest certification systems in the US are the Forest Stewardship Council and the Sustainable Forestry Initiative. While these have widespread use in other parts of the US and, nearby, particularly in Maine, where over 7 million acres are certified, there has been less interest in New Hampshire. Almost 605,000 acres (or 13% of the state’s timberland) are certified in New Hampshire under these two programs. Tree Farm is the longest standing certification program but the recent decline of funding to this long-standing program is threatening its viability since it runs primarily on volunteer efforts with funding from the national program. As of 2010 there were 1,540 certified Tree Farms with over 569,762 acres.

### 15. Employment and wages in forest-related sectors

As forest products manufacturing in New Hampshire and North America face the global competition brought on by inexpensive Russian timber and lower cost manufacturing in places like China and South America, employment in the sector is hardest hit. Manufacturing facilities must upgrade their technology and equipment to run more efficiently and keep unit costs down or they will go out of business as margins get smaller and smaller. Many mills in New Hampshire have increased production while reducing employment. **Figures 44 and 45** tell this story. In 2001 the forest products industry employed almost 11,000 people directly, that number fell to 9,200 in 2005. As of 2008 the number fell to about 7,200, illustrating the closing of several facilities and the overall national economy. Over this time period paper manufacturing and wood products manufacturing workers, which are the largest sectors, encoured the largest losses.

Figure 44

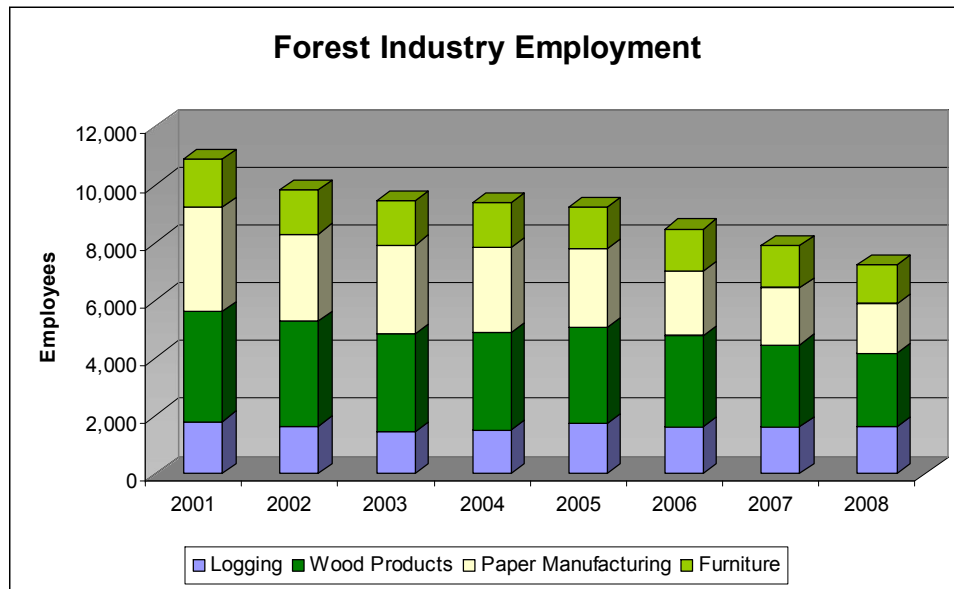
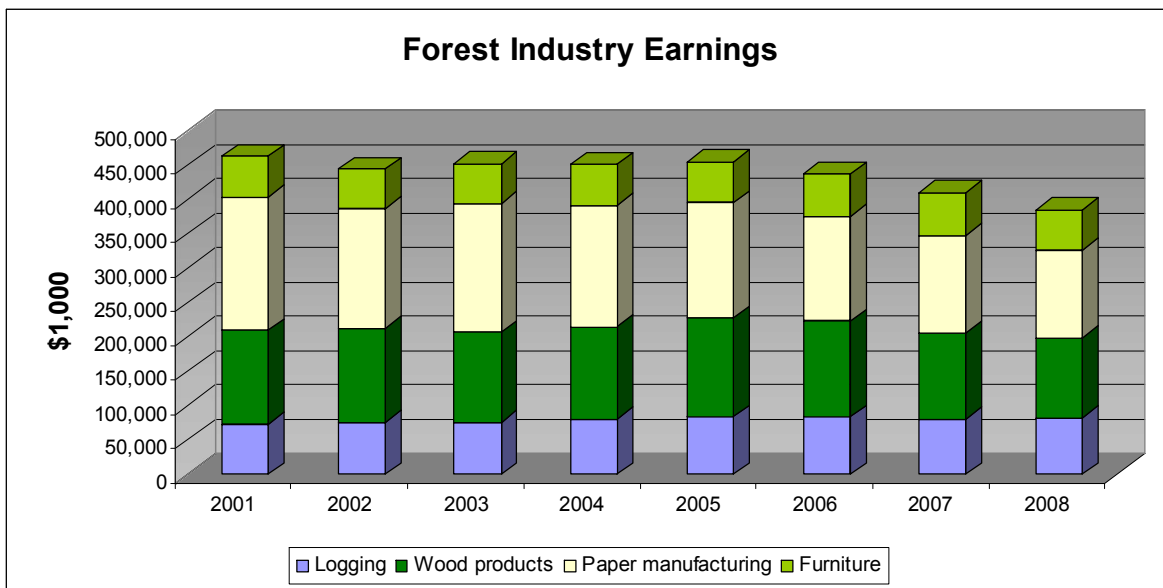


Figure 45



People in forest and wood-products manufacturing are likely to have living-wage jobs and good benefits. There are several economic metrics to help measure the size and health of the forest products sector. The US Dept. of Commerce collects data on total earnings, wages and salary, and compensation. Many of those data are currently trending downward. The domestic forest products market are hurt by the housing market, global trade and the national recession. Not surprisingly, the 2008 earnings data is the lowest in recent history. In 2008 total earnings was nearly \$385 million, down from a high of \$463 million in 2001. Employment in forest-related recreation is estimated at 11,500 full-time employee equivalents, but total payroll is \$ 181 million annually. Average annual wage in the forest related recreation sector is \$ 14,454.

The Division of Forests and Lands has 53 full time employees in 2010, in the near term the division is expected to lose employees because of a state wide hiring freeze and retirements. This number is up from a low of 40 in the 1990's, but still lower than a high of over 60 in the mid-1980s. The UNH Cooperative extension Forestry and Wildlife program also employs over a dozen natural resource specialists. The Durham Field Office employs about 40 federal researchers and specialists and the White Mountain National Forest has over 80 full time natural resource managers.

## **CRITERION 7:**

### **Legal, Institutional, and Economic Framework for Forest Conservation and Sustainable Management**

#### ***16. Forest management standards/guidelines***

New Hampshire has a series of laws and regulations designed to assure sustainable management of timber and non-timber attributes on forestland in New Hampshire. The state's laws are not found in a comprehensive forest practices act like some states – where all the forestry related topics fall under one title – but the list of laws in New Hampshire, is nevertheless, wide-ranging.

New Hampshire has laws requiring permitting to harvest (Intent to Cut and Report of Cut), water quality protection (wetland and alteration of terrain laws), timber tax, forester licensing, and some wildlife related regulations. Other states in the region have similar laws and regulations, though some are packaged in forest practices acts. **Table 9** provides a comparison of broad law categories for New Hampshire and the surrounding states of Maine, Massachusetts and Vermont.

**Table 9**  
**Forestry Laws and Regulations – some New England States**

<b>Type of Law</b>	<b>NH</b>	<b>VT</b>	<b>ME</b>	<b>MA</b>
Forester Licensing	X		X	X
Logger Licensing				X
Forest Practices Act			X	X
Water Quality regulations	X	X	X	X
Timber tax	X			
Intent to Harvest permitting	X		X	X
Cutting/Management Plan Approval		Certain	Certain	X
Wildlife Management Requirements	Some	Some	Some	Some

*Source: Ellefson et al, REGULATION OF FORESTRY PRACTICES ON PRIVATE LAND IN THE UNITED STATES: ASSESSMENT OF STATE AGENCY RESPONSIBILITIES AND PROGRAM EFFECTIVENESS, October 2004*

A review of the laws referenced in the table reveals that one area covered by laws in all three of these states but not New Hampshire is that of intensity of cutting practices not associated with road or wetland buffers – or more specifically – clearcutting or heavy cutting. All three of these states regulate certain size (or larger) clearcuts to an extent. Permits and extra planning is required when associated with these kinds of harvest. New Hampshire is the only state of these four with a timber (severance) tax.

#### ***17. Forest-related planning, assessment, policy, and law***

Beyond the state statute requirement for a Forest Resources Plan (and to be revised every 10 years), a significant amount of forest related planning goes on the New Hampshire. The Forest Stewardship Program, funded with federal dollars, has encouraged forest management planning on private forestlands for years.

**Table 10** shows the progress made there since 1990. New Hampshire has over 775,000 acres under official forest stewardship plans. Certified Tree Farms must also have written management plans. Other private forestland is required to be covered by forest management plans as well, such as the over 600,000 acres under the forest certification programs. Other private forest acreage is covered by formal plans as well.

**Table 10**  
**NH Forest Stewardship Plans**

	<b>New Plans</b>	<b>Revised Plans</b>	<b>New Acres</b>	<b>Revised Acres</b>	<b>Total Plans</b>	<b>Total Acres</b>
<b>1990</b>	—	—	21,600	—	—	21,600
<b>1991</b>	237	—	48,418	—	237	48,418
<b>1992</b>	265	—	37,615	—	265	37,615
<b>1993</b>	262	—	55,462	—	262	55,462
<b>1994</b>	190	31	28,520	31,671	221	60,191
<b>1995</b>	186	24	26,958	19,236	210	46,194
<b>1996</b>	115	28	26,805	5,297	143	32,102
<b>1997</b>	139	18	39,640	7,262	157	46,902
<b>1998</b>	108	18	14,143	3,554	126	17,697
<b>1999</b>	182	60	35,128	19,203	242	54,331
<b>2000</b>	102	25	20,835	9,955	127	30,790
<b>2001</b>	94	27	15,336	32,149	121	47,485
<b>2002</b>	36	20	9,626	18,742	56	28,368
<b>2003</b>	15	14	20,772	24,669	29	45,441
<b>2004</b>	53	11	26,043	12,426	64	38,469
<b>2005</b>	60	16	161,833	2,266	76	164,099
<b>Totals</b>	<b>2,044</b>	<b>292</b>	<b>588,734</b>	<b>186,430</b>	<b>2,336</b>	<b>775,164</b>

Source: DRED

A comprehensive forest management planning is underway for all state lands under the management of the Division of Forests and Lands. The revision of the White Mountain National Forest Plan (covering over 800,000 acres – nearly all of which is in NH) was completed in 2006.

Formal statewide plans have become more numerous than one would expect. Though not all of them affect forests specifically, many involve forestlands, forest industry, or other areas of concern to New Hampshire's forest community. The recently developed Wildlife Action Plan through NH Fish & Game is one such plan that directly affects NH's forests since its recommendations for conservation and management largely fall on forested habitats. **Table 11** provides a brief list of the statewide plans.

<b>Table 11</b>	
<i>NH Wildlife Action Plan--update</i>	2010
<i>NH Transportation Business Plan</i>	2006
<i>State Comprehensive Outdoor Recreation Plan</i>	2002
<i>NH Comparative Risk Project (ranked risks)</i>	1998
<i>White Mountain National Forest Plan</i>	2005
<i>NH Energy Plan</i>	2002
<i>NH State Parks Commission Report</i>	2006
<i>State Development Plan</i>	2000
<i>Climate Change Action Plan</i>	2009
<i>Ten Year Strategic Plan – NH Division of Parks</i>	2010

**Conclusion** – This Assessment component of the revision process for New Hampshire’s Forest Resource Plan is marked by one major theme – change. Most particularly, the change that is resulting from the conversion of forestland to non-forest uses as a result of the development pressure and growth being felt in the Granite State. Like nothing else, these forces will continue to work to change the fabric of what New Hampshire’s forests represent.

## ***PRIORITY FOREST LANDSCAPES for NEW HAMPSHIRE***

It is becoming increasingly commonplace to use GIS (Geographic Information Systems) to inform natural resource management. One common practice is to collect several geographic data layers and lay them on top of one another in what is called an overlay analysis. These layers are added together and where the different layers intersect they accumulate a higher score. The final layer is that of relative landscape values across an area. When done across a large landscape this becomes an informative forest planning tool. The Division of Forests and Lands developed four priority forest landscape maps; one urban forest landscape map, and three rural forest landscape maps based on the USDA Forest Service national priorities (themes).

One theme of the forest planning effort is to conserve working forest landscapes (**Figure 46**). Several data layers were selected to create an overlay analyses for this specific theme. The layers used for New Hampshire were; unfragmented forest blocks, important forest soils, NH Wildlife Action Plan, timber tax revenue created, drinking water, and conservation lands. Although, there is a range of numerical values, the data is arranged to give a relative value of high, medium or low.

Another theme is enhancing public benefits from trees and forests (**Figure 47**). This analysis is designed to emphasize ecosystem services and social benefits of forests. As an example the GRANIT conservation lands data layer was used. The layer was queried to select parcels that offer the chance for greater recreational opportunities (public access). The layers used were unfragmented forest blocks, NH Wildlife Action Plan, timber tax revenue created, stream boundaries, drinking water, and conservation lands.

New Hampshire forests are under threat from insect pests, weather events, development, and fire. Protecting forests from harm (**Figure 48**) is another national theme. Layers used for this analysis generally delineated some form of environmental threat or degradation. For example, the ability to produce clean water (APCW) layer was queried to show areas with some level of impairment. This same layer was used in the “enhancing public benefits” analysis, only it was filtered to show areas with higher ranked water quality. Other data layers used were areas of known forest damage, active outbreaks of hemlock wooly adelgid (**Figure 26**), NH fire risk assessment, rapidly developing towns, and smaller forested blocks.

Lastly, an analysis was conducted to locate urban forestry opportunity areas (**Figure 49**). New Hampshire is a rural state but also one that is rapidly growing. Many town and cities, especially in the south, are expanding in population and this brings changes to both the urban and rural landscapes. This analysis was conducted to illustrate the confluence of population centers and environmental quality. Data layers used were from the “Maryland Method”, housing density, air quality non attainment areas and APCW.

It should be noted that this type of analysis is created with the most current data layers available from state and federal agencies. That said, many of these layers require frequent updating, like the conservation land data layer. Some datasets, like soils, are incomplete. Currently, no digital soil data for the White Mountain National Forest exists. And some data layers will become out dated and may be replaced with newer or different data. As such, this type of analysis should be considered a snapshot in time and may not be able to keep pace with our changing environment.

Figure 46

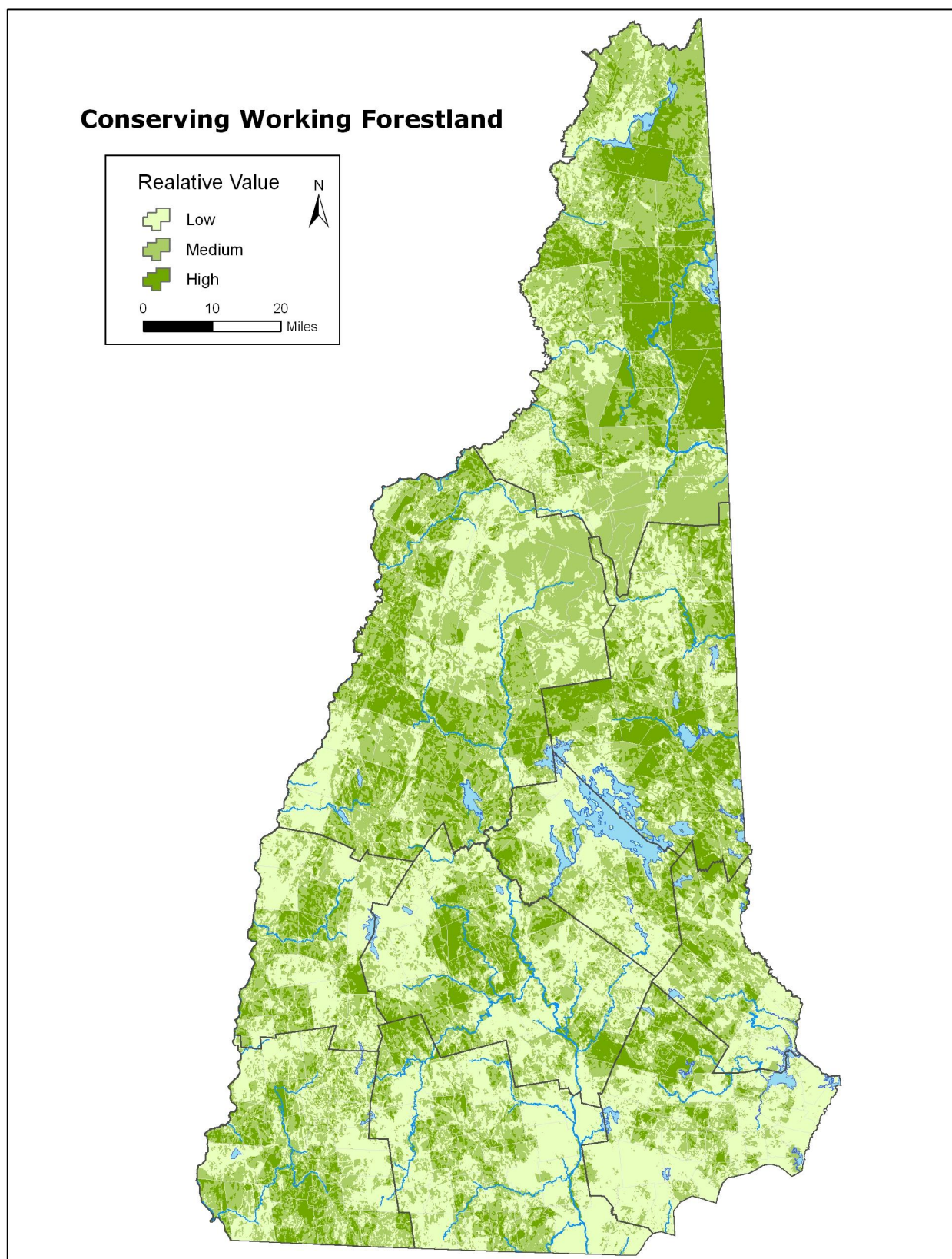


Figure 47

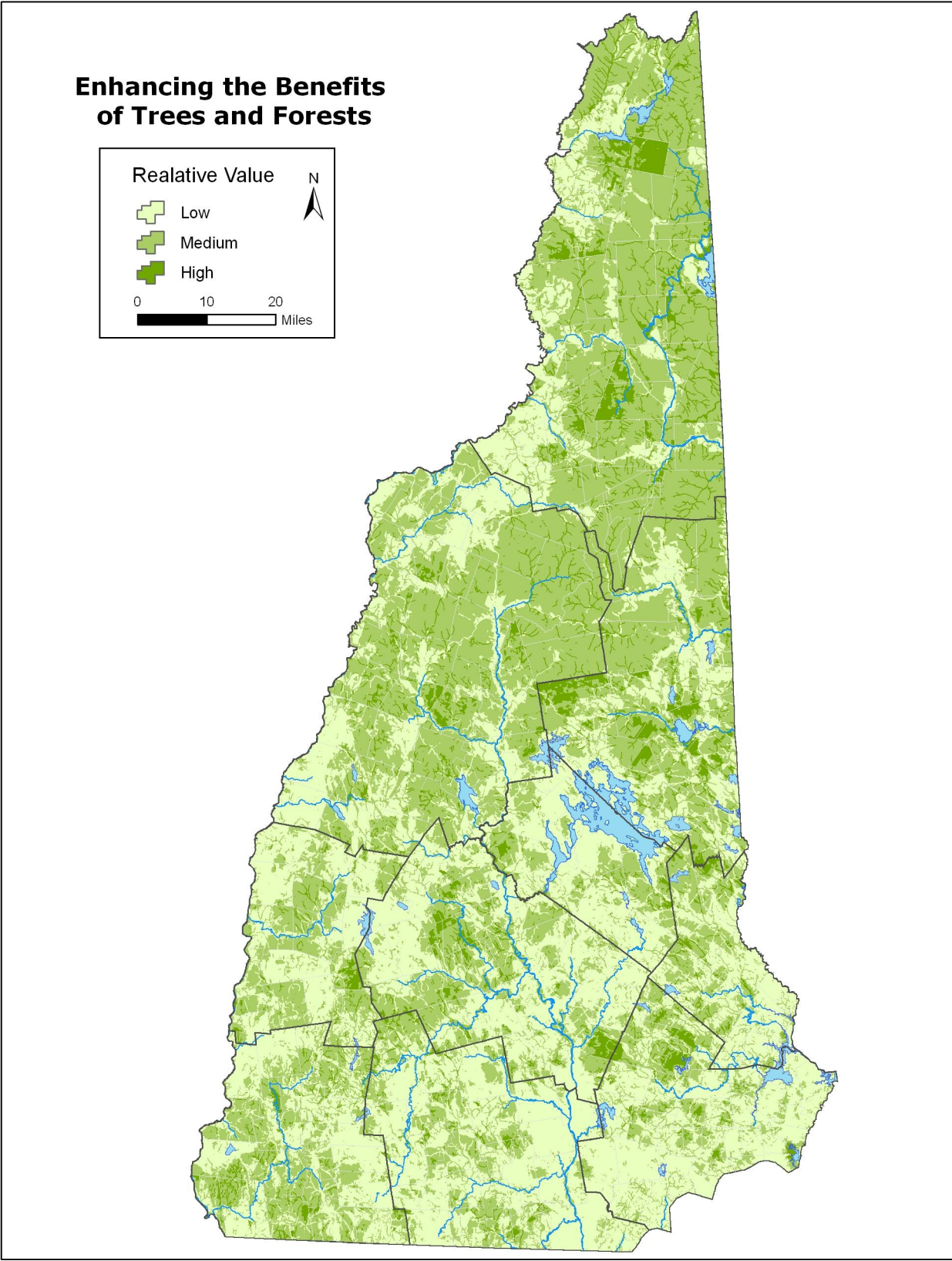


Figure 48

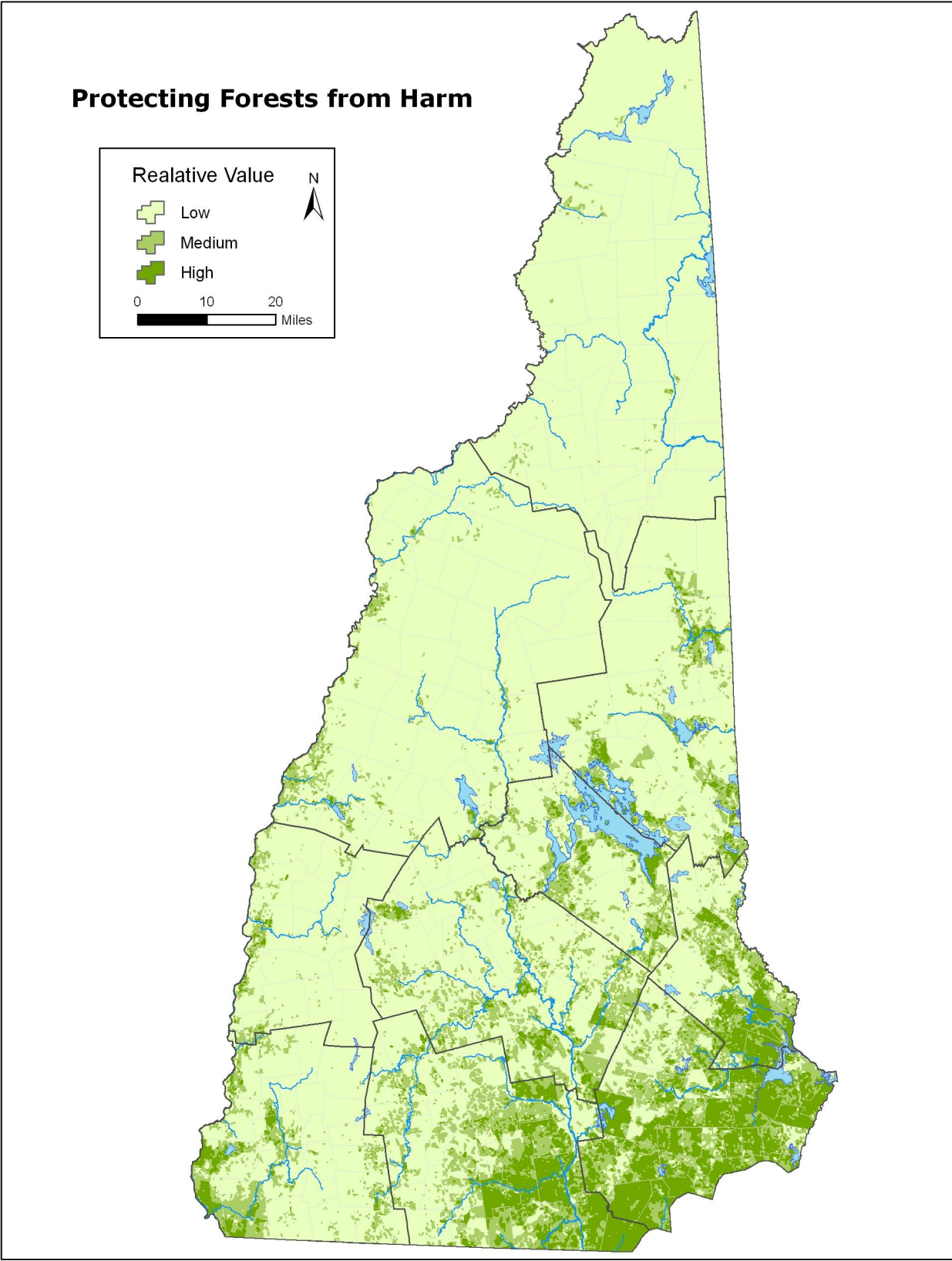
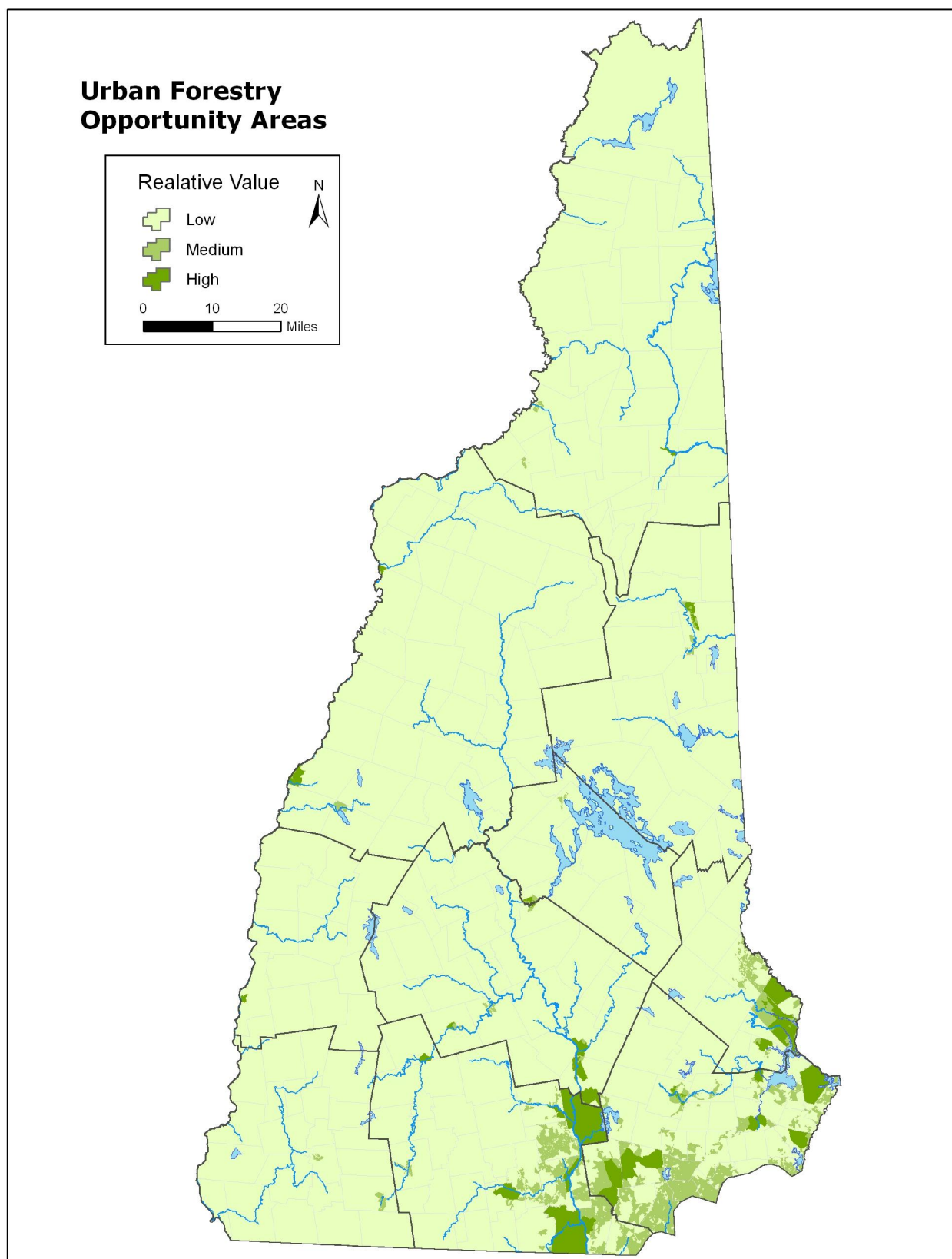


Figure 49



## **MULTI-STATE PRIORITIES**

The New Hampshire Division of Forests and Lands has a long and successful tradition of working collaboratively on projects and policy development. Projects have ranged from Forest Health efforts such as Asian Longhorned Beetle detection and eradication to wildland fire prevention with the Northeastern Forest Fire Protection Compact and participation in the four-state North Eastern *State* Foresters Association (NEFA). These cooperative efforts enable states to better address areas of common opportunity or concern.

New Hampshire has identified the following multi-state priority forest areas (**Figure 50**):

Northern Forest Lands (NFL) – New Hampshire’s northern most county (Coos) lies within the planning area for NFL which stretches over 20 million acres from Maine to New York. This area was the focus of a regional study and planning effort in the 1990’s. Issues needing attention include forest land conservation, economic development and community infrastructure.

States: Maine, New Hampshire, Vermont, New York

Connecticut River Valley - The Connecticut River is the largest river in New England. It flows south from northern New Hampshire and forms the state border between Vermont and New Hampshire. Continuing through western Massachusetts and into central Connecticut, it flows into Long Island Sound. According to the US Forest Service publication “Forest on the Edge” this is one of the most at-risk areas of New England for forest fragmentation. Issues associated with this area include invasive species control, urban and agricultural runoff impacting water quality, fisheries and wildlife habitat.

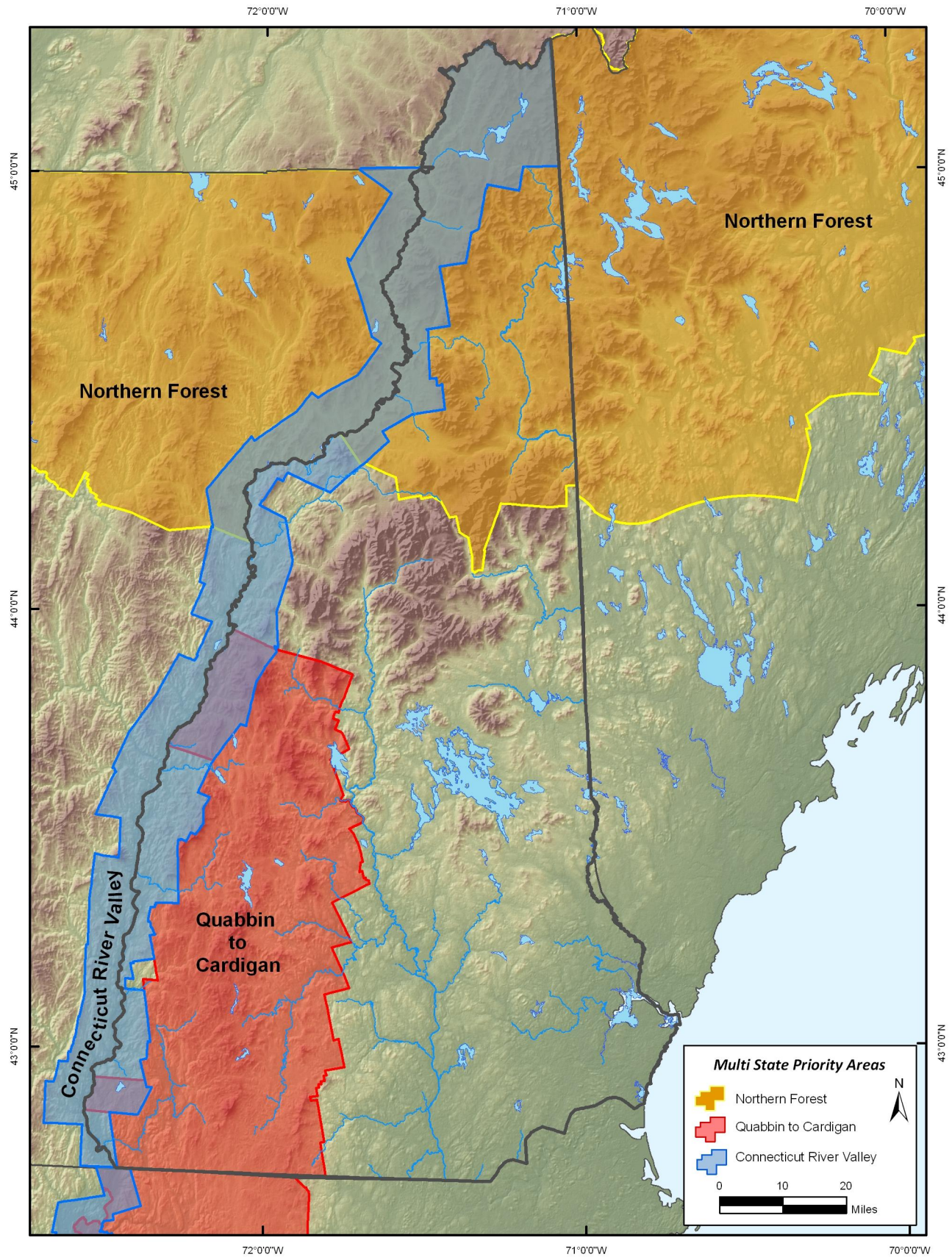
States: Vermont, New Hampshire, Massachusetts, Connecticut

Quabbin to Cardigan Corridor - The Quabbin to Cardigan region encompasses more than 3,000 square miles in the Monadnock Highlands of central Massachusetts and western New Hampshire. The region contains one of the largest remaining areas of intact contiguous forest in central New England. The region is the watershed boundary between the Connecticut and Merrimack River valleys and the highlands provide habitat for many species of migratory birds and wide-ranging wildlife—animals that are in decline elsewhere in New England due to habitat fragmentation. The area’s forests also form the basis of a vibrant tourism, recreation and forest products economy.

To address issues of concern in the region the Quabbin to Cardigan Partnership (Q2C) was formed in 2000. Since that time the partnership’s efforts have helped to protect more than 60,000 acres. The Q2C partnership includes a unique assemblage of 27 state and federal public agencies (USFS, NRCS, FSA, RD and state forestry and economic development agencies), private conservation groups, forestry organizations and landscape-scale partnerships.

States: New Hampshire and Massachusetts

Figure 50



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